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PROCEEDINGS AND EVIDENCE

OF THE

SELECT SPECIAL COMMITTEE

ON THE

POLLUTION OF NAVIGABLE WATERS

REVISED EDITION.

PRINTED BY ORDER OF PARLIAMENT



OTTAWA

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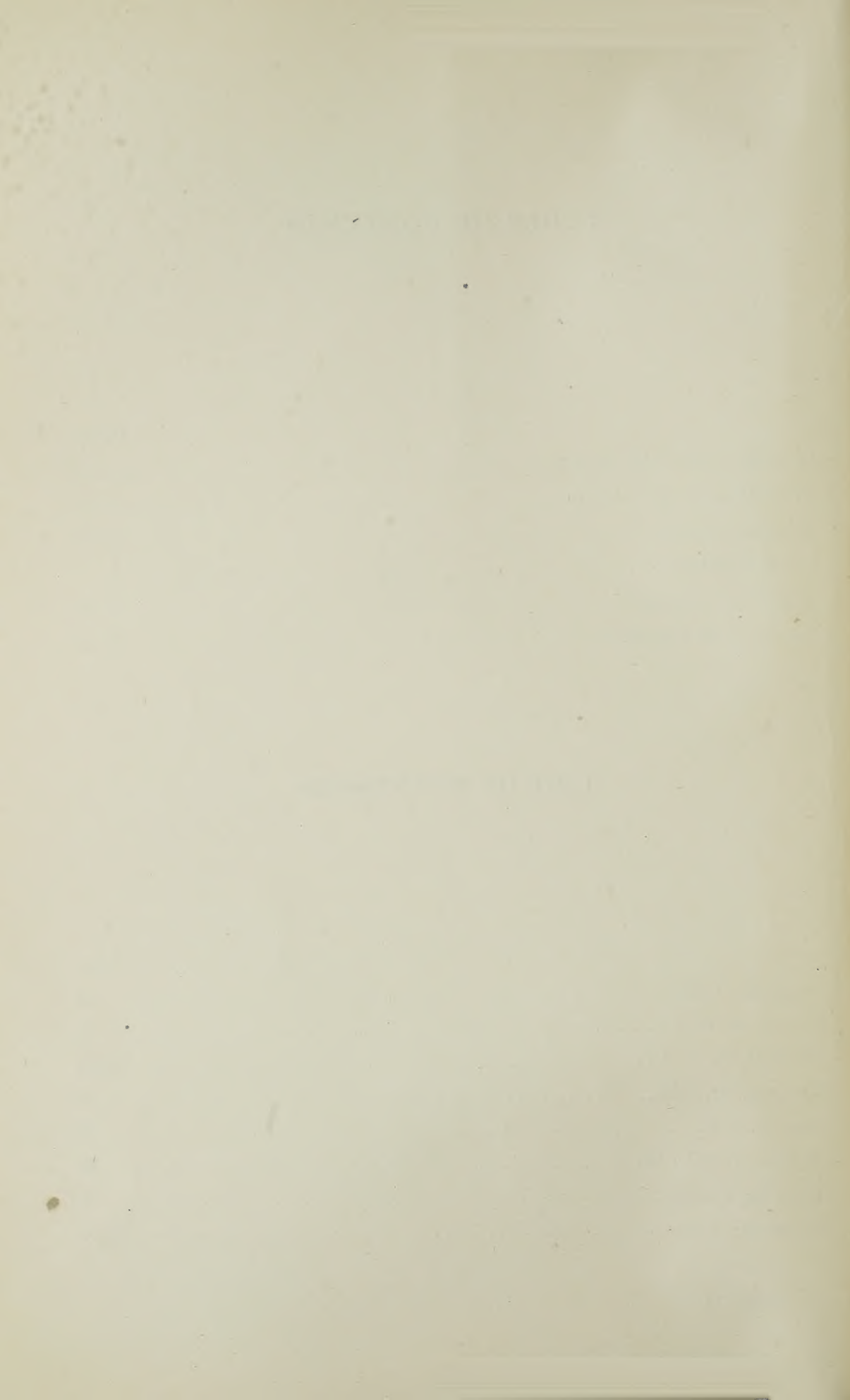


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SELECT SPECIAL COMMITTEE ON THE POLLUTION OF NAVIGABLE  
WATERS.

ORDER OF REFERENCE.

FRIDAY, April 25, 1913.

*Resolved.*—That the Bill No. 2, An Act respecting the Pollution of Navigable Waters, be referred to a Select Special Committee consisting of Messieurs: Baker, Béland, Boyer, Bradbury, Burrell, Crocket, Hazen, Kyte, Lesperance, McCoig, McCraney, McCurdy, Molloy, Murphy, Northrup, Sevigny, Warnock and Wilson (Wentworth), with instructions to inquire into and consider the said Bill and all matters with which the said Bill is concerned, and to report thereon to this House with all convenient speed, and that the said Committee have power to send for persons, papers and records, and to examine witnesses on oath or affirmation.

*Attest*

(Sgd.) THOS. B. FLINT,  
*Clerk of the Commons.*

FRIDAY, April 25, 1913.,

*Ordered.*—That the Bill No. 116 (Letter A of the Senate) intituled "An Act respecting the Pollution of Navigable Waters" be referred to the said Committee.

FRIDAY, May 2, 1913.

*Ordered.*—That the quorum of the said Committee be reduced to six members.

MONDAY, May 5, 1913.

*Ordered.*—That the names of Messieurs Carroll, Edwards, and Steele be added to the said Committee, and that the name of Mr. Chisholm (Inverness) be substituted for that of Mr. Molloy on the said Committee.

WEDNESDAY, May 7, 1913.

*Ordered.*—That the said Committee be given leave to have their proceedings and all evidence taken by them, printed from day to day for the use of the members of the said Committee and that Rule 74 be suspended in reference thereto.

*Ordered.*—That the said Committee be given power to report from time to time.

THURSDAY, May 8, 1913.

*Ordered.*—That the names of Messieurs Chabot and Devlin be added to the said Committee.

MONDAY, May 12, 1913.

*Ordered.*—That the said Committee have leave to sit while the House is in Session.





THE HOUSE OF COMMONS OF CANADA.

BILL 2.

(Mr. BRADBURY.)

An Act respecting the Pollution of Navigable Waters.

HIS Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1. No person shall put or deposit, or cause or permit to  
5 be put or deposited, or to flow or be carried, any sewage,  
offal or refuse, or any matter that is poisonous, noxious,  
decomposing, refuse or waste, into any navigable water or  
into any other water that flows into any navigable water,  
unless such matter is disposed of in accordance with regula-  
10 tions made under the authority of this Act.

Deposit of  
sewage etc.,  
in navigable  
waters  
prohibited.

2. Every municipal corporation convicted of an offence  
against this section shall, upon summary conviction, be  
liable to a fine of not less than five hundred dollars and an  
additional sum of fifty dollars for each day during which  
15 the offence continues.

Penalties.  
Municipal  
corporations

3. Every corporation, other than a municipal corpo-  
ration, convicted of an offence against this section shall,  
upon summary conviction, be liable to a fine of not less than  
two hundred dollars and an additional sum of twenty dollars  
20 for each day during which the offence continues.

Other  
corporations.

4. Every person, other than a corporation, who is con-  
victed of an offence against this section shall, upon sum-  
mary conviction, be liable to a fine of not less than fifty  
dollars and an additional sum of ten dollars for each day  
25 during which the offence continues, or to imprisonment  
not exceeding two months, or to both fine and imprison-  
ment.

Individuals.

2. The Governor in Council may make such regulations  
as are necessary to carry out the purposes of this Act, and  
30 such regulations shall be carried out and enforced by the  
Director General of Public Health, and shall have force and

Regulations.

Enforcement

effect as and from the date of their publication in *The Canada Gazette*.

Commence-  
ment of Act.      **3.** Where, at the date of the passing of this Act, any  
sewage or matter referred to in subsection 1 of section 1 of  
this Act flows into any navigable water, or into any other      **5**  
water which flows into any navigable water, this Act shall,  
in the case of municipal corporations, come into force two  
years after it is assented to by the Governor General, and  
in the case of other corporations and of persons shall come  
into force six months after such assent.

# THE SENATE OF CANADA.

## BILL A. No. 116.

AS PASSED BY THE SENATE, 31st JANUARY, 1913.

(Hon. N. A. BELCOURT.)

An Act respecting the Pollution of Navigable Waters.

WHEREAS it is expedient to make provision for the prevention of the pollution of navigable waters: Therefore, His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

Preamble.

1. In this Act the expression "the Minister" means the Minister of Agriculture.

Interpretation.

2. Every person is guilty of an offence against this Act and liable on summary conviction to the penalties herein after provided, who puts, or causes or permits to be put or to fall, flow, or to be carried into any navigable water, or into any other water any part of which is navigable or flows into any navigable water,—

Prohibition of placing sewage and other refuse matter in navigable waters, except according to regulations

(a) any solid or liquid sewage matter; or,

15 (b) any other solid matter which, not being sewage, is poisonous, noxious, putrid, decomposing, refuse, or waste; or

(c) any liquid matter which, not being sewage, is poisonous, noxious, putrid, decomposing, refuse or

20 waste;

unless such matter, whether solid or liquid, is disposed of in accordance with regulations or orders made or permits granted under the authority of this Act.

2. A person, other than a municipal or sanitary authority, shall not be guilty of an offence under this section in respect of the passing of sewage matter into a drain communicating with any sewer belonging to or under the control of any municipal or sanitary authority, if he has the sanction of the municipal or sanitary authority for such passing.

Exception of private persons using public sewers.

Penalties.  
Corporations

3. Every corporation convicted of an offence against this Act or of a violation of any regulation or order made or permit granted under the authority of this Act shall be liable to a fine not exceeding five hundred dollars and an additional amount not exceeding fifty dollars for each day the offence continues. 5

Individuals.

2. Every person, other than a corporation, who is convicted of any such offence or violation shall be liable to a fine not exceeding fifty dollars and an additional amount not exceeding ten dollars for each day the offence continues, or to imprisonment not exceeding two months, or to both such fine and imprisonment. 10

Disposal  
of fines  
recovered.

3. All sums of money recovered under this section shall be paid into the Consolidated Revenue Fund of Canada and shall be applied in such manner as is by the Governor in Council deemed best adapted to promote the objects of this Act and to secure its due administration. 15

Regulations  
by Governor  
in Council.

4. The Governor in Council may make such regulations, general or special, as are requisite or expedient to carry out the purposes and intent of this Act; and the said regulations shall have force and effect as of and from the date of the publication thereof in *The Canada Gazette*. 20

Authorities  
and officers  
for  
enforcement  
of Act.

2. The Minister may appoint such officers as he deems necessary to carry out and enforce the provisions of this Act, and may also designate any existing board of health or sanitary authority, or other person, for such purposes. 25

Order and  
permits by  
Minister

3. The Minister may make such orders and grant such permits as are provided for in such regulations.

Appeal from  
Minister's  
order, etc.

5. Any order or decision of the Minister under the regulations provided for in this Act shall be subject to an appeal to the superior court of original jurisdiction in the province in which such order or decision is to be enforced; and the said superior court shall have power to affirm, set aside or vary such order or decision; but pending the final determination of any such appeal the order or decision appealed from shall stand and be binding and the execution thereof shall not be stayed. 30 35

Form of  
appeal.

2. The appeal shall be in the form of a special case to be agreed upon by both parties, or their attorneys, and if they cannot agree, to be settled by a judge of the said superior court upon the application of one of the parties or his attorney. 40

Enforcement  
of orders.

6. The superior court of original jurisdiction in the province in which an offence against this Act has been committed or in which any order or decision given under this Act by the Minister or by the said superior court is to be enforced, may, by summary order, require any corporation, 45



municipality or person to abstain from the commission of such offence or to comply with such order or decision, and generally may give such directions for carrying such order or decision into effect as to the court seems meet.

- 5     **7.** Subject to the provisions of this Act, and in so far as Procedure  
they are not incompatible therewith, all enactments, rules in courts  
and orders relating to proceedings in the superior courts of  
original jurisdiction in the several provinces or appeals  
thereto, shall apply to proceedings had or appeals taken  
10 under this Act in the same manner as if such proceedings or  
appeals related to a matter within the ordinary jurisdiction  
of the said courts.

- 8.** Sections 2 and 3 of this Act shall not come into Date and  
operation as to any area, district or locality, until a date mode of  
15 to be appointed by the Governor in Council by proclama- operation  
tion published in *The Canada Gazette* and in such other of Act.  
way as may be deemed advisable. Such proclamation  
shall also describe clearly such area, district or locality.

- 2.** The Governor in Council may from time to time as  
20 he deems advisable issue proclamations published as afore-  
said bringing the said sections 2 and 3 into operation as to  
additional areas, districts or localities.

- 3.** Any proclamation issued under this Act may be re-  
voked or amended from time to time, such revocation or  
25 amendment to be made known by proclamation published  
as aforesaid.



# SELECT SPECIAL COMMITTEE ON THE POLLUTION OF NAVIGABLE WATERS.

## REPORTS.

### FIRST REPORT:

FRIDAY, May 2, 1913.

The Select Special Committee appointed to consider Bills No. 2 and No. 116, respecting the Pollution of Navigable waters, beg leave to present their FIRST REPORT as follows:—

Your Committee recommend:—

1. That they be given leave to sit while the House is in Session, and
2. That their quorum be reduced from ten to six members.

### SECOND REPORT:

WEDNESDAY, May 7, 1913.

The Select Special Committee appointed to consider Bills No. 2 and No. 116, respecting the Pollution of Navigable Waters, beg leave to present the following as their SECOND REPORT, viz.:—

Your Committee recommend that they be given power to report from time to time; also that leave be given them to have their proceedings and all evidence taken by them printed from day to day, for the use of their members, and that Rule 74 be suspended in reference thereto.

### THIRD REPORT.

FRIDAY, May 30, 1913.

The Select Special Committee appointed to consider the Bills No. 2 and No. 116 (Letter A of the Senate), respecting the Pollution of Navigable Waters, beg leave to present the following as their Third and final report:—

Your committee met and organized on Friday May 2 last, and altogether have held six sittings, and have heard the testimony of the following persons, viz.:—Mr. James White and Dr. Hodgetts, of the Commission of Conservation; Mr. Joseph Race, F.I.C., Municipal Bacteriologist of the city of Ottawa; Dr. W. T. Connel, Professor of Bacteriology and Hygiene at Queen's University, Kingston; Mr. R. S. Lea, C.E., and Mr. John Kennedy, C.E., both of Montreal; Professor C. H. McLeod, Vice-Dean of the Faculty of Applied Sciences at McGill University, and Dr. Bryce, Medical Inspector, Immigration Branch of the Department of the Interior, Ottawa.

Owing to the very late period of the session at which your committee were appointed, they have been unable to make much progress with the inquiry entrusted to them, but the evidence already adduced has greatly impressed them with the vast importance of the subject under investigation, and has convinced them that it is a

matter of urgent necessity that this inquiry should be prosecuted to a conclusion at as early a date as possible.

Your committee greatly regret their inability, through lack of time, to proceed further into this inquiry during the present session, and they beg to submit herewith the minutes of their proceedings and of the evidence so far taken by them, and they earnestly recommend that your committee be reappointed at an early period next session with a view of enabling them to carry to completion the inquiry now begun, and of permitting such legislation to be passed as may be necessary to carry into effect any conclusions or recommendations which may be submitted by the committee.

On the assumption that this inquiry will be re-umed next session, your committee have asked Dr. Hodgetts of the Commission of Conservation who is about to proceed to England on official business, to make further inquiries as to the latest method of sewage disposal in that country, and the working of the local government board in reference thereto, and to obtain any further information as to water conditions in the United Kingdom as may be useful for the purposes of the inquiry; your committee are also in communication with the proper authorities with a view of having the necessary instructions issued to the topographical surveyors now working in the western provinces to gather all possible information and data regarding the rivers and streams in the said provinces for the purposes of your committee; from these and other sources it is expected that much valuable and useful information will be available for consideration should the inquiry be resumed next session as recommended.

Your committee would specially invite the attention of the House to the following points adduced in the evidence submitted, as in their opinion specially emphasizing the immense importance of an inquiry of this kind, and the paramount necessity, in the interests of public health, of determining as soon as possible the best practical means of effectually preventing the pollution of our navigable waters:—

Mr. JAMES WHITE:

Q. Have you any data or information as to how wide an expanse of water would be necessary to prevent pollution on this side (of the great lakes), or can you rely at all upon the distance?—A. The great lakes undoubtedly act as great sedimentation basins. The public health authorities of Ontario have gone half way across Lake Ontario from Toronto collecting samples of water all the way. They found bacteria right out to the middle of the lake. Of course, we can concede that the chances of the sewage of a city like Rochester infecting the supply of a town like Port Hope or Cobourg are somewhat remote; but you cannot say that it will not. The most important point of all is that the population on the shores of the Great Lakes and the St. Lawrence is increasing, and, as the population increases, the danger of infection also increases.

Q. What is the distance between Rochester and Cobourg?—A. The distance across the lake is approximatively 40 miles, I should say.

Q. Is that sufficient to purify the water?—A. We have traced the pollution half way across the lake. Of course we assume that the pollution they get in the middle of the lake is Toronto's pollution, because, of course, Toronto is the largest city on the shores of Lake Ontario, and the pollution was found practically opposite that city. They were trying to discover whether by extending their intake pipe out a reasonable distance they would get beyond the polluted area; and they came to the conclusion that they could not.

Q. Is the water from the Great Lakes used for domestic purposes by the city?—A. Yes, that is what the city of Toronto depends upon. They have instituted a very large filtration plant, but other cities along the lakes are using the unfiltered water.

Q. Even though we may not be able to induce the Americans to take the same action as we do, you say that we will be entirely justified in acting without regard to



what they do in International waters?—A. I do, most decidedly, because we cannot throw stones at them so long as we are sinning ourselves.

Q. It would have a good effect on them if we took action?—A. Yes. Of course as they have a larger population, they are the greatest offenders.

Q. We are reducing our own risk, even if they do not do anything?—A. Yes. On the shores of the Great Lakes we are the greatest sufferers, because every municipality is discharging untreated sewage into the lake and is also drawing its water supply from that lake; it is polluting its own water supply, if not to-day, then to-morrow, because the currents change with the winds and seasons.

Mr. JOSEPH RACE, F.I.C.:—

The effects of the pollution of navigable waters have chiefly been reflected in the abnormal death rates from enteric diseases, and it is these rates that have attracted public attention to this serious problem. At the outset it should be remembered that it is the use of such water for drinking purposes without purification that is the cause of so many deaths, and that the sewage problem has become acute on account of the failure of communities to realize their responsibilities in that direction.

We come now to the other aspect of this problem. If the sewage pollution of navigable waters is allowed to continue and the population continues to increase, a stage must ultimately be reached when they become impossible as a source of domestic water supply and finally a nuisance.

Q. What is your opinion regarding the whole question of the prevention of the pollution of streams?—A. I think that all sewage pollution and trade wastes ought to be prevented from running into the rivers unless thoroughly purified.

Q. Do you agree with other scientists that typhoid is a water borne disease almost entirely?—A. Not almost entirely, but a large proportion of it is.

Q. You believe that it is a disease that is preventable?—A. Yes, certainly.

Q. What percentage is preventable by legislation?—A. I should say at least 75 per cent.

Q. Then according to your statement your opinion is that if we had proper sewage protection in the city of Ottawa we would have had at least 75 per cent fewer typhoid cases and deaths during these epidemics?—A. Undoubtedly.

Dr. W. T. CONNELL:

Q. If there were typhoid fever at Kingston, would that not increase the danger of infection at the towns below?—A. I think that we can say that either typhoid fever cases or typhoid carriers are constantly present in every town and city, hence that a certain number of typhoid bacilli are being daily discharged with untreated sewage into the rivers and lakes by practically every town and city in this country.

Q. If there were anything of an epidemic, of course that danger would be increased?—A. Provided the excreta were not disinfected, as they are supposed to be by law.

Q. Speaking generally would there be any suggestion you could make which would be applicable?—A. Every city should treat its own sewage in such a manner as to render it harmless to any other cities or towns which may take their supply from below.

Q. And harmless to itself also?—A. Of course, to itself, the selfish reason would apply first. As I have said, I think our own experience has been that the danger is very largely to one's own town first, and secondly to those below, and so for purely selfish reasons we should treat our sewage and thus not injure ourselves, and secondly, not to injure others.

Q. As the population of the country increases, will the danger increase or lessen?—A. It will increase with the growth of population unless proper safeguards are adopted.

Q. You think the time will come when it will be absolutely necessary for us to take some action?—A. Undoubtedly. We will be forced to do it some time if we do not do it now.

Dr. HODGETTS:

The results of the pollution of our lakes and rivers have been clearly indicated in the report of the Commission of Conservation, and it is a fact that in many instances typhoid fever in most of our cities and towns is due to this careless and criminal method of polluting our lakes and rivers by human excreta in an untreated state. I quite agree with Dr. Connel that it is not so much polluting the water supply of other municipalities, but that it is polluting their own water supply.

That the time has passed for a continuance of this reprehensible practice is quite apparent from the legislative action of many of the provinces. That action by the Federal Government is necessary in order to make the work effective and uniform is evidenced by the unanimous findings of the Conference, as reported by the Commission of Conservation.

Mr. R. S. LEA, C.E.:

Q. Can you give us any idea as to what the probable diminution in the death rate from typhoid would be if the Government took hold of this question and dealt with it systematically and successfully?—A. I think it would reduce the death rate to one-third or one-fourth. Not only would the average death rate be reduced but the danger of epidemics would be greatly diminished, and in many cases would be prevented altogether.

Mr. JOHN KENNEDY, C.E.:

Q. What class of officials are you referring to?—A. Medical officers in connection with Boards of Health. We have such a Board in our municipality, and my experience of such men is that they know practically nothing of the scientific part of the question that we are dealing with, and that is why I suggest that properly trained men, in sanitation, should be secured. That is no reflection on the medical men at all. The whole sanitary science has grown extremely rapidly and the older men, both engineers and doctors, have hardly kept pace with it. They have been busy with other things. Our railway engineers do not need to trouble their minds at all about it. They have other questions that keep them exceedingly busy and the ordinary practitioner in the country understands that bad water hurts people, but what way to get rid of that bad water he is not prepared to say; but surely men ought to be trained in this science, which has grown so rapidly. Our pollution is increasing very fast and we understand so much better now what is needed to make wholesome water and wholesome conditions of health generally. Some kind of scientific training is urgently needed.

In conclusion your committee, having in view the gravity of the present situation, and the importance of having some action taken at as early a date as possible to prevent the continuance of the practice now so prevalent of polluting the waters of the country by the discharge therein of untreated sewage and other offensive matter, recommend that the Government endeavour to arrange, during the coming recess of Parliament, for a Conference of Representatives of the Dominion, of each of the Provinces, of the International Waterways Commission, and the Chairman of this Committee, for the purpose of fully discussing the whole subject, with a view of endeavouring to overcome local difficulties, and of agreeing upon some form of remedial legislation which could be passed concurrently by the Dominion Parliament, and by the Legislatures of the various Provinces.

All which is respectfully submitted.

GEORGE H. BRADBURY,  
Chairman.

SELECT SPECIAL COMMITTEE ON THE POLLUTION OF NAVIGABLE  
WATERS.

MINUTES OF PROCEEDINGS.

FRIDAY, May 2, 1913.

The Committee met at 11 o'clock a.m.

PRESENT:—*Messieurs* Béland, Bradbury, Hazen, Kyte, McCurdy, Murphy, Northrup and Warnock.

On motion of Hon. Mr. Hazen, seconded by Hon. Mr. Murphy, Mr. Bradbury was elected Chairman of the Committee.

On motion of Hon. Mr. Hazen it was

*Resolved.*—That the Committee do recommend to the House that the Committee be given leave to sit while the House is in session, also that the quorum of the Committee be reduced to six members.

On motion of Hon. Mr. Hazen the Chairman was authorized to make a motion in the House for a Message to the Senate requesting that leave be granted to the Honourable Napoleon Antoine Belcourt to attend and give evidence before the Committee.

On motion of Hon. Mr. Hazen it was

*Resolved.*—That Mr. James White and Dr. Hodgetts, of the Commission of Conservation, be requested to attend and give evidence at the next meeting of the Committee.

The Committee adjourned till Wednesday, May 7th, at 11 o'clock a.m.

G. H. BRADBURY,  
*Chairman.*

WALTER TODD,  
*Clerk.*

WEDNESDAY, May 7, 1913.

The Committee met at 11 o'clock a.m.

PRESENT: *Messieurs* Bradbury (Chairman), Burrell, Carroll, Chisholm (Inverness), Crocket, Edwards, Hazen, Kyte, McCraney, Murphy, Northrup, Sévigny, Steele and Warnock, 14.

The minutes of the previous meeting were read and confirmed.

The Chairman reported that the names of Messrs. Carroll, Edwards and Steele had been added to the Committee, and the name of Mr. Chisholm (Inverness) substituted for that of Mr. Molloy.

The Clerk reported that Dr. Hodgetts was unable to attend at the present meeting, as he had to fulfil an engagement at Chicago, but that he would be free to attend any day next week.

Mr. JAMES WHITE, Secretary to the Commission of Conservation, was sworn and examined. He produced:

Exhibit No. 1.—Draft of Bill to Prevent Pollution of Navigable Waters, prepared by Commission of Conservation.

On motion of Mr. Edwards it was

*Resolved.*—That Dr. W. T. Connel, Queen's University, Kingston, be requested to attend and give evidence before the Committee.

On motion of Mr. McCurdy it was

*Resolved.*—That Mr. T. Aird Murray, of Toronto, be requested to attend and give evidence upon such day as may be determined.

Mr. JOSEPH RACE, bacteriologist of the city of Ottawa, was sworn and examined and discharged from further attendance. He produced

Exhibit No. 2.—A Statement of Analyses of the Waters of the Great Lakes (1912).

*Ordered.*—That Dr. Hodgetts, of Ottawa, and Dr. Connel, of Kingston, be requested to attend at the next meeting of the Committee.

On motion of Mr. Crocket it was

*Resolved.*—That the Committee do recommend that power be given them to report from time to time; also that leave be granted to print their proceedings and all evidence taken by them, from day to day, for the use of their members, and that Rule 74 be suspended in reference thereto.

The Committee adjourned till Tuesday next, May 13th, at 11 o'clock a.m.

G. H. BRADBURY,

*Chairman.*

WALTER TODD,

*Clerk.*

TUESDAY, May 13, 1913.

The Committee met at 11 o'clock a.m.

PRESENT:—*Messieurs* Bradbury (Chairman), Baker, Béland, Chisholm (Inverness), Edwards, Kyte, Northrup, Steele and Warnock—9.

The minutes of the last meeting were read and confirmed.

Dr. W. T. Connel, of Queen's University, Kingston, Ont., was sworn, examined and discharged from further attendance.

Mr. James White, secretary of the Commission of Conservation, was further examined and produced the following papers, viz.:—

Exhibit No. 3.—Memorandum *re* Cost of Sewage Treatment.

Exhibit No. 4.—Laws of the Provinces and of certain States in the Union on Sewers and Sewage Systems; and memoranda in reference thereto.

Exhibit No. 5.—Statement of Cities, Towns and Villages with a population of upwards of 1,000, which discharge into navigable waters.

Dr. C. A. Hodgetts, of the Commission of Conservation, was sworn and examined in part, he submitted the following:—



Exhibit No. 6.—Statement of Deaths by Typhoid Fever in the Provinces of Canada in 1911.

The Chairman read a letter received from Professor McLeod, secretary to the Canadian Society of Civil Engineers, to the effect that the society had named Messrs. John Kennedy and R. S. Lea, of Montreal and Mr. Willis Chipman, of Toronto, as a committee to assist this committee, if required.

On motion of Mr. Edwards, it was

Resolved, That either Mr. John Kennedy or Mr. Lea be requested to attend at the next meeting.

The Committee adjourned till Friday next at 10.30 a.m.

WALTER TODD,  
*Clerk.*

GEO. H. BRADBURY,  
*Chairman.*

FRIDAY, May 16, 1913.

The Committee met at 11 o'clock a.m.

PRESENT:—Messieurs Bradbury (Chairman), Béland, Chabot, Chisholm (Inverness), Kyte, Murphy, Northrup and Warnock—8.

Mr. R. S. Lea, C.E., of Montreal, was sworn, examined and discharged from further attendance.

Mr. John Kennedy, C.E., of Montreal, was sworn, examined and discharged from further attendance.

Mr. C. H. McLeod, Secretary of the Canadian Society of Civil Engineers, being present was invited to make a statement, he was then sworn and examined and discharged.

On motion of Mr. Northrup it was

Resolved, That Mr. C. H. McLeod be paid his expenses from Montreal and return as though regularly summonsed.

Ordered, That Mr. T. Aird Murray, C.E., of Toronto, and Dr. Hodgetts, of Ottawa, be requested to attend at the next meeting.

The Committee adjourned till Wednesday next at 10.30 a.m.

WALTER TODD,  
*Clerk.*

GEORGE H. BRADBURY,  
*Chairman.*

WEDNESDAY, May 21, 1913.

The Committee met at 10.30 a.m.

PRESENT:—Messieurs Bradbury (Chairman), Steele and Warnock—3.

Examination of Dr. Hodgetts, Commission of Conservation, was continued. He submitted—

43403—2½

Exhibit No. 7.—Statement of cost of sewage disposal for Palmerston, Bridgeburgh and Preston in Ontario.

On motion of Mr. Steele, it was

*Ordered*, That the Clerk write to Hon. C. Sifton, Chairman of the Commission of Conservation, requesting him to instruct Dr. Hodgetts to make further inquiries, during his proposed visit to England, as to latest methods of sewage disposal and the work of the Local Government Board in reference thereto and to obtain any other information on water conditions in England which would be of any use to this Committee and to prepare and submit a report thereon.

The Committee adjourned to the call of the Chair.

WALTER TODD,  
*Clerk.*

GEORGE H. BRADBURY,  
*Chairman.*

FRIDAY, May 30, 1913.

The Committee met at 10.30 o'clock a.m.

PRESENT:—Messieurs Bradbury (chairman), Baker, Chabot, Northrup and War-nock.

Dr. P. H. Bryce, Medical Inspector, Immigration Branch, Department of the Interior, was sworn, examined and discharged from further attendance.

On motion of Mr. Chabot it was

*Resolved*, That the Clerk of the Committee is hereby authorized to communicate with the proper authorities with a view of having instructions issued to the topographical surveyors now in the field in the western provinces to gather all such information and data in reference to the rivers, streams and lakes in those provinces as may be useful for the purposes of the inquiry, which will presumably be renewed next session.

On motion of Mr. Northrup it was

*Resolved*, That whereas, in the opinion of the Committee, sufficient evidence has been taken to show the gravity of the situation, and the importance of something being done to prevent the pollution of our rivers, lakes and streams, and with a view of expediting the inquiry when reopened next session the Committee do recommend that the government should endeavour to arrange, during the coming recess of parliament, for a conference of representatives of the Dominion, of each of the provinces, of the International Waterways Commission, and the Chairman of this Committee, for the purpose of fully discussing the whole subject, and with a view of endeavouring to overcome local difficulties, and of agreeing upon some form of remedial legislation which could be passed concurrently by the Dominion Parliament and the Legislatures of the various provinces.

The chairman submitted the following draft report, which was read:—

(For this Draft Report see Third Report of the Committee, page 13.)

On motion of Mr. Northrup the above Draft Report was adopted as the Report of the Committee and ordered to be presented in the House on Monday next.

On motion of Mr. Northrup it was

Ordered, That the Minutes of Proceedings, the Minutes of Evidence and the Appendix be presented with the Report.

The committee adjourned *sine die*.

GEORGE H. BRADBURY,  
*Chairman.*

WALTER TODD,  
*Clerk.*





# SELECT SPECIAL COMMITTEE ON THE POLLUTION OF NAVIGABLE WATERS.

## MINUTES OF EVIDENCE

WEDNESDAY, May 7, 1913.

The Committee met at 11 o'clock a.m., the Chairman, Mr. Bradbury, presiding.

The CHAIRMAN.—Before calling on Mr. White, the Secretary of the Commission of Conservation, whom we have with us to-day, I would just like to say a word or two. I consider that this is perhaps one of the most important committees that the House of Commons has appointed this year. The duties that will devolve upon this Committee, I think, are very important. When one realizes that typhoid is a preventable disease—and science has established that fact—it seems the imperative duty of the House of Commons to take drastic measures to stamp out if possible this disease. That our great waterways have been polluted beyond anything that one would imagine, has been confirmed, I think, by statements and evidence submitted all over the country, and I would ask the hearty co-operation of every member of this Committee in trying to make this Bill a success. I am satisfied that if we can get a Bill to stop this pollution of streams through the House, we shall have performed a great public duty. I have now pleasure in calling on Mr. White.

Mr. JAMES WHITE, sworn.

Mr. HAZEN.—I would suggest that before Mr. White is questioned by the Committee, it would be well if he told us something as to what the Conservation Commission have done in regard to this matter, what information they have gathered and can lay before us. I would also like Mr. White to give us information regarding the legislation passed in different States of the American Union, and in different European countries, with regard to the preservation of their streams from pollution. I know there is legislation of that sort. Perhaps Mr. White might also tell us if the Commission have considered the question of what arrangements might be made with the States in regard to this matter. This is of international importance, owing to the fact that in many parts of Canada the rivers are boundary rivers on which are situated many cities in the United States as well as Canadian cities. Other rivers, like the River St. John in New Brunswick, take their rise in the United States and may become polluted there by towns and cities along their banks, and this would have to be considered in any effective scheme. Perhaps Mr. White could make a general statement as to what information the Conservation Commission have gathered together, and what steps they have taken in regard to the matter.

The WITNESS.—When the Secretary telephoned me, respecting my attendance before the Committee, nothing definite was set forth respecting the exact information you desired. I regret to say that I have been a bit under the weather since I got the notice and, consequently, have not been able to prepare for this morning a memorandum such as I would have liked. Of course, to prepare a memorandum of that nature would require considerable work, and could not be done in the time at my disposal. So far as the Conservation Commission is concerned, I may say that, in October, 1910, we had a Public Health Conference, which was attended by a number

of gentlemen who were interested in public health work. We invited particularly representatives of the various Provinces. Each Province was requested to send its principal Medical Health Officer, and, in addition, all the Health Officers of the Dominion Government were invited. As a result of that Conference a number of resolutions were passed, one respecting the pollution of streams; and a draft Bill was prepared, a copy of which I have here and will be pleased to submit to the Committee. (See Exhibit No. 1).

Subsequent to the preparation of that draft Bill, a Bill was introduced by Senator Belcourt and another by Mr. Bradbury, which are now before the Senate and the House respectively.

So far as the health laws of the separate States of the Union are concerned, I am unable at present to lay before you a statement of that nature, but that can readily be prepared, and if desired I can submit it to the Committee at a subsequent meeting. Respecting the international waterways, the Great Lakes and connecting streams, and rivers like the St. John which take their rise in the United States, these are very complicated matters which at present are particularly engaging the attention of the International Joint Commission. The International Joint Commission has had some difficulty in arriving at a conclusion respecting the exact extent of their jurisdiction and I understand that there has been some difference of opinion between some members of the Commission. Some members of the Commission desired to take a very broad view of the references made to them, and others were inclined to greater restriction. The general tendency, I think, is to restrict it to the connecting streams rather than the Great Lakes. The real question at issue, of course, is to what extent does pollution affect the Great Lakes and other boundary waters. Is it possible for pollution from a city on the south shore of the lake, say, to effect a city on the north shore of the lake? Is it possible, say, for the city of Cincinnati or Cleveland to affect the municipalities and towns on the Ontario shore of Lake Erie? The matter was further complicated by the fact that in the United States power is explicitly given to the different States to make their own health laws, and therefore we were confronted with the various laws of all the States fronting upon our international boundary. In Canada, on the other hand, health matters are explicitly given to the Dominion by The British North America Act, although subsequently it was judged advisable to transfer them to the Provinces.

For the proper consideration of any Health Act or any Act affecting the pollution of streams—that is to say, if we are to bring forward any legislation dealing explicitly with the pollution of streams—I think we must go to England. Mr. George Whipple, in a recent address before the United States Society of Civil Engineers, in England, said that “we could see more, hear more and learn more of sewage disposal in England than anywhere else in the world.” Now, if it is the desire of the Committee, I will briefly turn to what has been done in England in recent years.

The CHAIRMAN.—I think that is the wish of the Committee.

The WITNESS.—In England, at the present time, the pollution of streams is governed by the so-called Rivers Pollution Act of 1876. A Royal Commission, fortunately, was appointed in 1901, which has issued from time to time various reports. The final report came out in 1912, and it is of exceptional value because it undoubtedly represents the last word in sanitary science, so far as the pollution of streams is concerned. The so-called Fifth Report was issued in 1908 and contained most of the Commission's conclusions, but in 1912 it was supplemented by another called the Eighth Report, which is the final one regarding the pollution of rivers and streams. It is only a very small one, a matter of sixteen pages, but with this report of 1908 it constitutes the final conclusions of the Commission and I have no doubt that the Rivers Pollution Act of 1876 will be somewhat modified in view of the conclusions presented in these two reports.

One of the principal conclusions of the Commission defined the standard for sewage effluents. That has always been a moot point for sanitary engineers the world over. What is the standard to apply to a stream below which it shall be considered as polluted and above which it shall be considered as unpolluted—what you might call “clean” water. Not to go into any unnecessary technical details, they arrived at the conclusion that when water from the dry weather flow of a stream takes up no more than 0.4 part per 100,000 of dissolved oxygen in five days, it would be considered clean water: that is, sixty per cent of saturation. So they considered it permissible to reduce the total amount of oxygen which the water is capable of taking up, by forty per cent.

One of the most important points urged by the Commission was the necessity for a Central Authority. In England, the County Councils have, hitherto, been invested with power to enforce the Rivers Pollution Act. The Commission urged the absolute necessity of appointing such Central Authority—probably the present local Government Board—and Rivers Boards. Of course, the conditions in England are not exactly analagous to conditions in Canada. In England they have a number of small streams, a very dense population, and intensive manufacturing, with, of course, a discharge of enormous quantities of industrial waste, so that the Rivers Boards would not necessarily be applicable to Canada, except in the case of of a few streams like the St. Lawrence, which are of unusual importance.

Another point which they emphasized, indirectly, is the need of elasticity, that is to say, any law that is passed must be elastic in its operation. Although they recommend the standard I have referred to, still, they also concede that the tendency of a standard is to level down rather than to level up, so they only put this forward as a suggested standard. They acknowledge that it is necessary to be stricter in some cases, and that in others it is quite permissible to relax it. Take the case of two municipalities on a stream, one, of course, above the other. If the upper municipality were allowed to reduce by its sewage the standard of that stream down to the maximum allowed by this suggested standard it might easily impose great hardships upon the municipality below, because the basic principle of the whole legislation is that a municipality must not make its water worse below its discharge than it is above its intake. Therefore, if this municipality were allowed to reduce this water until it barely came within the standard permitted, the lower municipality would have an undue burden of purification placed upon it. That is one reason for the Central Authority, because it may require the upper municipality to apply a greater degree of purification to its effluent in order that an undue burden may not be placed upon the lower one.

Another point of great importance is that they concede that it is not possible to apply any “blanket” provisions to all municipalities. Provisions that are applicable to large cities must be modified for what we might call smaller cities and larger towns, and, again, for smaller municipalities. They recognize, of course, that it is not possible to impose such a burden upon a municipality that the financial strain will be greater than what might fairly be imposed upon it; and, with that idea in view, they have suggested various measures applicable to these municipalities. A large city, of course, would have to install very large sewage treatment works, whereas, for the smaller municipalities, they would be content with a comparatively minor treatment, such, for instance, as the precipitation of the solids—to run the sewage effluent into large tanks and precipitate the solid by sedimentation or by the addition of chemicals, which would increase the percentage of precipitate.

They also place much stress upon the necessity for efficient maintenance. That is, of course, absolutely necessary. The best sewage treatment works in the world, if not kept in efficient operation, are worse than worthless, because the municipality and people on the stream below it rely upon its discharging a reasonably pure effluent when, as a matter of fact, it may be polluting the water to a dangerous degree.

MR. JAMES WHITE.



*By Mr. Hazen:*

Q. Is there a law in Great Britain which prevents any sewage which is untreated being placed in any river or stream?—A. That is the practical effect of the law. But, of course, in practice the trouble is that we are apt to use a misnomer; we are continually talking about sewage purification whereas we should say sewage treatment.

Q. Does sewage have to be treated before being allowed to flow into any river or stream?—A. Practically, yes. Of course, the government recognize the fact that a small amount of sewage passing into a large stream is not injurious. That is what it amounts to. The effluent from any of the very best sewage treatment works is not 'pure.' That is to say, they say: if you draw your water from a stream which is in any way liable to pollution you must purify your water supply; we do not intend to allow you to draw water from a stream which is liable to sewage pollution, even supposing that water is normally good. You must not only treat your sewage, but you must purify your water supply. Of course, that does not apply to large municipalities which draw their supplies from the mountains in the north of England or the mountains in Wales, because in these cases the municipalities have absolute control of the watersheds, and it is impossible for these to become contaminated.

*By the Chairman:*

Q. Does the city of London, England, not draw a large percentage of its water from the Thames?—A. Yes. It is all purified. The water supply of the Thames is held in reservoirs for about a month. Sedimentation, of course, is one of the best methods of reducing the bacteriological content of the water supply that is known. After standing in the sedimentation basins it is further purified by being run through slow sand filters.

*By Mr. Hazen:*

Q. Do I understand that the sewage in the water running into the Thames has to be treated before it goes into the river, and that before being used for domestic purposes the water has to undergo further purification?—A. Yes.

Q. It is treated at both ends?—A. Yes. In the case of London, it is on the Thames at tidewater, and the sewage purification works, of course, are below the city; and this effluent is discharged into tidal waters. The recommendations of the British Royal Commission are largely with reference to non-tidal waters, although they also say that they recommend in a general way that the same provisions be made with reference to tidal waters. If there is no question of the pollution affecting sea beaches or shell-fish, or creating a local nuisance, and, if your sewage has been treated so as to make it inoffensive, it is quite permissible to discharge large quantities of sewage effluent into tidal waters. In the case of London, of course, they draw their water supply from certain very highly polluted waters. Raw water from the Thames has been inoculated with typhoid bacilli till there were 475,000 per cubic centimeter. At the end of three weeks there were 2 per cubic centimeter. Then, of course, they rely upon the slow sand filtration to remove nearly all the remaining bacteria.

Speaking in a general way, the proposed methods of the Royal Commission are, for cities rapid filtration through sprinkling or contact beds, with subsequent settlement of the effluent before discharge. For small cities, rapid filtration through sprinkling or contact beds; and for small municipalities settling alone. That is, in very brief form, the principal recommendations of the British Royal Commission.

Q. Have you considered what the effect would be, say on the St. Lawrence, if cities on the Canadian side were prevented from putting raw sewage into the stream, and if nothing was done to prevent cities on the American side from depositing their sewage in that river?—A. So long as the municipalities on the American side are allowed to discharge into the St. Lawrence, while the probability of an outbreak of typhoid in Canada would be very much reduced, it would not be prevented. If the

municipalities on the United States side of the line are to be allowed to discharge their sewage untreated into the St. Lawrence it would be better to install some treatment of the water before using it for a domestic water supply.

*By Mr. Murphy:*

Q. That is on the Canadian side?—A. Yes.

*By Mr. Edwards:*

Q. Take the great expansions of the St. Lawrence river, for instance, Lake Ontario and Lake Erie: suppose sewage was treated on the Canadian side and not on the American side, have you any data or information as to how wide an expanse of water would be necessary to prevent pollution on this side, or can you rely at all upon the distance?—A. The Great Lakes undoubtedly act as great sedimentation basins. The public health authorities of Ontario have gone half way across Lake Ontario from Toronto collecting samples of water all the way. They found bacteria right out to the middle of the lake. Of course, we can concede that the chances of the sewage of a city like Rochester infecting the supply of a town like Port Hope or Cobourg are somewhat remote; but you cannot say that it will not. The most important point of all is that the population on the shores of the Great Lakes and the St. Lawrence is increasing, and, as the population increases, the danger of infection also increases.

*By Mr. Crocket:*

Q. What is the distance between Rochester and Cobourg?—A. The distance across the lake is approximately 40 miles, I should say.

Q. Is that sufficient to purify the water?—A. We have traced the pollution half way across the lake. Of course we assume that the pollution they get in the middle of the lake is Toronto's pollution, because, of course, Toronto is the largest city on the shores of Lake Ontario, and the pollution was found practically opposite that city. They were trying to discover whether by extending their intake pipe out a reasonable distance they would get beyond the polluted area; and they came to the conclusion that they could not.

*By Mr. Murphy:*

Q. Was a corresponding experiment made from the American shore out to the middle of the lake?—A. I think not. But if the International Joint Commission decide to take a broad view of the references made to them they will do that.

*By Mr. Hazen:*

Q. Can this matter be dealt with by the Joint Commission?—A. That depends on the view they will take of it. I think they can myself, but, as a layman, my opinion has no weight.

Q. They have had the matter before them?—A. Yes.

Q. And there has been a difference of opinion?—A. Yes.

Q. Has Mr. Casgrain taken a different view from Messrs. Powell and Magrath?—A. I do know this, that the American Commissioners seem to favour the narrower view of the case.

Q. That is, they cannot deal with the question of pollution from one country to the other?—A. They want to confine the investigation to the connecting streams, the St. Clair, the St. Mary river, the St. Lawrence river, and the Niagara river.

*By Mr. Edwards:*

Q. You say that investigations have been made which show the water to have been polluted half the distance across Lake Ontario. How are these samples taken—at different depths? And, if so, what does that show?—A. That, I could not tell

Mr. JAMES WHITE.



you. The question really came up in connection with this discussion respecting the reference to the Joint International Commission; and this was put forward as a reason why the Commission should take the broader view of the reference to them.

*By Mr. Northrup:*

Q. I suppose the lake is narrower at Toronto than between Cobourg and Rochester?—A. There is not very much difference.

Q. Opposite Toronto you would have the point where the Toronto sewage is on the one side and the Buffalo sewage on the other?—A. Coming down the Niagara river.

Q. It would be the worst place on the whole lake to take the samples?—A. The only thing is that we imagine the tendency of the Niagara river is not so much to flow directly across the lake as to turn in a north-easterly direction. That can only be decided by putting in floats.

Q. It just struck me that probably it would be the worst place in Lake Ontario you could get for germs?—A. Yes, that is exactly what we want to do. If we can prove our point even in the worst case that is all we desire.

Q. Will the direction of the prevailing winds make it more likely that the pollution would be carried from the north shore towards the south than it would be from the south shore towards the north?—A. Yes, but when the lake is open in the summer time the prevailing winds are chiefly from the west.

*By Mr. Kyte:*

Q. Is the water from the Great Lakes used for domestic purposes by the city?—A. Yes, that is what the city of Toronto depends upon. They have installed a very large filtration plant, but other cities along the lakes are using the unfiltered water.

*By Mr. Murphy:*

Q. Has not the International Waterways Commission considered the matter of the diversion of water at Chicago affecting pollution of the water supply?—A. No, sir, they have not. That would only come in very indirectly, and the only way that question would enter into consideration would be that if you reduce the water in a system by 5 per cent you of course increase the pollution of the remaining 95 per cent. That is the only polluting effect.

*By the Chairman:*

Q. Do you consider in the interests of the public generally, that it is necessary for Parliament to take some action on the matter?—A. I do, sir. The only thing I would like to dwell upon in that connection is the necessity for the Officers of the Board to be given all the power possible, if such Central Authority is established, and if such Act is passed, to deal with each and every application or case that comes up for consideration independently and on its merits. No two municipalities are in exactly the same position; one of the western provinces thought that they could draft a plan of sewage treatment that would apply to all the municipalities in the Province.

*By Mr. McCraney:*

Q. You are referring to Saskatchewan, now?—A. I do not think it was Saskatchewan. That cannot be done. It is absolutely impossible. The conditions in each municipality differ, and each municipality must be dealt with according to the local conditions; the treatment applicable to one municipality will not be suitable to another. Supposing that one municipality treats its sewage by filtration; assume that municipality has some very sandy land in the vicinity which is almost worthless from a pecuniary point of view, it would be well suited for the treatment of that sewage; there is no better treatment. Another municipality may be surrounded by clay soil which is one of the worst materials possible for that purpose.

*By Mr. Murphy:*

Q. In your opening remarks you stated that after a meeting held here the Conservation Commission prepared a draft bill on the subject?—A. Yes.

Q. What became of that Bill?—A. It was printed in our Second Annual Report, and the substance of it was incorporated in the Hon. Mr. Belcourt's Bill, which contains a good many of the recommendations made. Of course our Bill was not in strictly legal phraseology, it was simply a statement in paragraphic form of what we considered should be done.

*By Mr. Hazen:*

Q. Is there a copy of that Bill here?—A. Yes. (*See Exhibit No. 1.*)

Q. All the provinces were represented in that conference?—A. All the provinces.

Q. And they were all favourable?—A. Yes, oh yes, all the representatives of the provinces were unanimous.

*By Mr. Northrup:*

Q. As I understand it, one of the difficulties arises from the fact that the individual states in the United States have control of the question of public health?—A. That is one of the difficulties which is bound to crop up when it comes to a question of jurisdiction and control over the pollution of the great lakes and of the International streams.

Q. It would depend altogether on the wording of the treaty, whatever that may be, but the federal authorities could not enjoy jurisdiction over matters that are within the jurisdiction of the States.—A. I am not a lawyer, and cannot express an opinion.

*By Mr. Hazen:*

Q. It could be done by treaty?—A. Oh, if it were done by treaty that, under the United States Constitution, is the first law of the land, then of course it would be effective.

*By Mr. Murphy:*

Q. There could then be one central authority?—A. Yes. Of course I recognize on the other hand, that we are not in the same condition as the United States, and when I say 'central authority' I am referring to Canada. If the United States will also establish their central authority—which will of course mean an amendment to the constitution—that would bring about a different state of affairs.

*By Mr. Carroll:*

Q. Did your commission take up the matter of the discharge of sewage into tidal waters, and harbours, the water of which is not used for domestic purposes?—A. We did not take it up as such, but we were particularly interested in waters liable to be used for domestic purposes.

Q. Then the discharge of raw sewage into such waters as I have mentioned is not deleterious or injurious if they are not used for domestic purposes?—A. Each case will have to be dealt with on its merits. It is easy to imagine a case where the sewage effluent would be quite a nuisance. Of course the question of potability does not enter into the matter at all in the case of tidal waters. As I said before in the case of Great Britain the possible creation of a local nuisance and the possibility of injury to shellfish has been dealt with.

Q. Coming back to the object of this Bill which is to prevent the pollution of navigable waters, the passage of sewage into waters such as I have mentioned would have no tendency to pollute those waters so that the pollution of them would be injurious to the public health.—A. I do not quite catch your point.

Mr. JAMES WHITE.

Q. I say that the idea contained in this Bill is the prevention of the pollution of navigable waters?—A. Yes.

Q. Now would the discharge of sewage into the waters of bays, arms of the sea, or in tidal waters which are not used for domestic purposes have any tendency to the detriment of public health?—A. I would not say so at all, it might be a nuisance; but I would not say it is injurious to the public health.

*By the Chairman:*

Q. Might it not have the effect of poisoning the shellfish which the public eat?—A. Yes, of course I was referring to the direct effect on public health.

Q. Well, if it poisoned the shellfish it would have an effect upon the public health, would it not?—A. Yes. That point was brought out very prominently in connection with the purification of the sewage, or I should say the 'treatment' of the sewage, of Baltimore. At Baltimore they give it what they call complete treatment, and then filter it. In that case, the oyster industry of Chesapeake Bay is probably the most valuable in the world, and the mere breath of suspicion as to the purity of the oyster supply would do enormous damage to that industry.

*By Mr. Carroll:*

Q. That condition more particularly refers to waters where the shellfish is an important industry?—A. Yes.

*By Mr. Northrup:*

Q. Was not there a similar case a few years ago in the Thames?—A. Yes, that was in 1902 or 1903.

Q. There was a serious epidemic in the shellfish there?—A. Yes, they dredged up the oysters and examined them. They found beyond doubt sewage pollution in the oysters, and, for months after that, in every case of typhoid that developed the first question asked the patient by the doctor was whether he had been eating oysters.

*By Hon. Mr. Hazen:*

Q. How did they correct that trouble?—A. I think they dredged up all the oysters and re-seeded them.

Q. And enacted strict laws with reference to the treatment of sewage going into the river?—A. Yes, but the principal thing was they destroyed all the oysters. They were not allowed to sell any of them; the authorities were very particular to see that not a single oyster off that bed was sold from the time they were first suspected to contain sewage pollution.

*By the Chairman:*

Q. Is it not a fact that all sewage is prevented from going into the Thames now?—A. Yes. The sewage effluent of the city of London is treated, all the solid materials are precipitated and then the sludge is put into very large tank vessels and taken away out to sea. There is a place called the 'Barrow Deep', a particularly deep portion practically the open sea, and about twenty miles below Southend, and there they dump it. They have examined that water there to ascertain whether the pollution from dumping was material, and they came to the conclusion that it was not, the dilution was so great. Of course, on the other hand you take the treatment of the city of Chicago sewage, where they are pouring it into the Chicago river, there it has become a dreadful nuisance. They have examined the water and they find that positively all the oxygen was removed from it; that means there is no oxydization going on of the material poured into that part of the river. The solid materials are deposited in the bottom and the process of decay is going on causing enormous quantities of gas to form. The explosion of these gases brings masses of this sludge



to the surface and the atmosphere for a considerable distance around is not by any means pleasant. Eventually they will have to put large dredges in there and dredge the whole thing out, and, while the dredges are at work, the vicinity will not be a very desirable locality.

Q. Even though we may not be able to induce the Americans to take the same action as we do you say that we will be entirely justified in acting without regard to what they do in International waters?—A. I do, most decidedly, because we cannot throw stones at them so long as we are sinning ourselves.

Q. It would have a good effect on them if we took action?—A. Yes. Of course as they have a larger population, they are the greatest offenders.

*By Mr. Northrup:*

Q. We are reducing our own risk, even if they do not do anything?—A. Yes. On the shores of the Great Lakes we are the greatest sufferers, because every municipality is discharging untreated sewage into the lake and is also drawing its water supply from that lake; it is polluting its own water supply, if not to-day, then to-morrow, because the currents change with the winds and seasons.

*By Mr. Kyte:*

Q. Has any action been taken by the United States authorities?—A. Towards preventing pollution?

Q. Yes? A. They have in some cases.

*By Mr. Hazen:*

Q. They have very strict legislation in some of the States?—A. Pennsylvania stands foremost in that respect.

Q. You are going to get us that information from the various States?—A. Yes, sir.

Q. Have you any statement at the Conservation Commission showing what the cost would be to the different municipalities and cities that are now discharging their sewage into navigable waters, if they had to put in a plant for the treatment of that sewage before it entered those waters, or if they had to dispose of it in some other way?—A. We have not prepared anything of that kind in exactly such a form as you state.

Q. Have you the machinery under which you could get that information for yourself?—A. What we would do is this: We could take certain municipalities which either have installed, or propose in the future to instal, sewage treatment plants, and we could give you the cost in those cases.

Q. You gave me a statement before this subject was discussed in the House. You took the city of Montreal and estimated that it would cost probably \$6 per head to treat the sewage there?—A. Yes, that is true, but I could not say off-hand what the cost would be in the case of the cities to which you refer. We could get data, either the actual cost or the estimated cost, for the installation of sewage treatment plants. A number of municipalities have already installed such plants and others are contemplating doing so. When the municipalities do not embark upon too ambitious a project, unless they are operating under very difficult circumstances, it does not impose any undue strain upon their financial resources. The principal item of cost is to put in the sewers.

*By Mr. Crocket:*

Q. Are there many municipalities in Canada that have installed sewage treatment plants?—A. I could not say off-hand. I prepared a statement last summer in that regard but I could not say at the moment just how many sewage treatment plants have been installed by municipalities.

Mr. JAMES WHITE.

Q. The number would be very few, it would not be more than a dozen?—A. Roughly, about twenty-five.

Mr. HAZEN.—The municipalities in the west are adopting that policy. I do not think there is a place in the east where it is carried out.

Mr. NORTHRUP.—In the east the streams are so convenient that they have not found it so imperative to treat their sewage.

*By the Chairman:*

Q. Have you given any thought at all to the cause of typhoid outbreaks?—A. I cannot say that I have. The whole subject has been investigated as regards the Ottawa epidemics.

Q. What would be your opinion as to the cause of the Ottawa epidemics?—A. I think Dr. Hodgett's investigation into the first typhoid epidemic in Ottawa absolutely demonstrated the cause.

*By Mr. Murphy:*

Q. Do you mind stating briefly what the cause was?—A. Doctor Hodgetts got a statement from the City Hall authorities respecting the dates upon which the so-called No. 1 valve was opened and the length of time during which it was open to enable the city to obtain the necessary pressure for fighting fires. The No. 1 valve, as you are probably all aware, is situated in Nepean bay, and there is only a comparatively short distance between it and the aqueduct which conveys the water to the pump house. This bay receives the drainage of a portion of the city—Mechanicsville—lying upon its banks, and also the drainage of a stream called Cave creek. The conditions on Cave creek were investigated and it was found in some instances that the privies were astride of that creek. The excreta of the people living in the adjoining houses was directly discharged into the stream, carried into Nepean bay, and of course infected the water. It was also found that there had been typhoid in that portion of the city and, as everyone knows, the excreta of typhoid patients contains millions of the typhoid bacillus. The thing was just as plain as that two and two make four.

Q. This pollution was carried directly into the intake pipe through this open valve?—A. Yes, through this open valve. The fact that the valve was open several times before the typhoid broke out simply indicates that during one or two of those openings the water in the vicinity of that intake valve was highly polluted with typhoid bacilli.

Q. The Conservation Commission issued a special report on that subject?—A. Yes.

Q. And that report is available for the purposes of this committee?—A. Yes.

The WITNESS.—Perhaps I might say, in case my remark has been misunderstood, that I did not wish in any way to reflect on the province of Saskatchewan.

Mr. McCRAVEY.—What the province of Saskatchewan has done is altogether to its credit.

The WITNESS.—Rather than desiring to reflect upon Saskatchewan I would like to say that it is the foremost province in Canada to-day with regard to the treatment of its sewage. The point I had in mind when I made the observation to which Mr. McCravey refers, was that it was proposed by some province in the West, I am not sure whether it was Saskatchewan or not, to pass a law that the health officer, or some engineer employed by him, should design a uniform sewage treatment plant for all the municipalities. What I was referring to was: that you could not have a uniform system for municipalities in different localities because conditions in each municipality vary to such a degree. There is no such thing as a standardized sewage treat-



ment plan, so that one system would apply to municipalities all over the country. The health laws of Saskatchewan, as I said before, are the best health laws in Canada.

Mr. McCraney.—Mr. T. Aird Murray, of Toronto, was, I believe, the consulting engineer to the Saskatchewan government with regard to this legislation which has been referred to. In conversation with him on the very point that Mr. White has mentioned, I understood there was no attempt to lay down any strict rule of procedure, that each case must be dealt with according to the local conditions when the time came for the municipality to act. I would like to move that Mr. Murray be summoned as a witness to appear before the committee.

*By Mr. Crocket:*

Q. Has not the Conservation Commission also got statistics showing the mortality from typhoid in the different communities in Canada?—A. I presume Doctor Hodgetts has that information, I am not in a position to say definitely.

Witness retired.

Mr. JOSEPH RACE, F.I.C., sworn.

*By the Chairman:*

Q. You are bacteriologist for the city of Ottawa?—A. Yes. Previous to that I was chemist on the Filtration Plant of Toronto. Previous to that I was assistant public analyst in the old country, where I had charge both of the water supply and sewage treatment.

Q. What part of the old country?—A. Northeast Lancashire.

Q. How long were you connected with that work in the old country?—A. About ten years.

Q. How long have you been in Canada?—A. Just over two years.

The CHAIRMAN.—Would it not be wise for Mr. Race at the outset to give the committee a synopsis of the work in which he has been engaged?

The WITNESS.—I have prepared a memorandum which will not take me more than half an hour to read.

The CHAIRMAN.—I think the committee is willing to hear you, so you may proceed.

The WITNESS.—The effects of the pollution of navigable waters have chiefly been reflected in the abnormal death rates from enteric diseases, and it is these rates that have attracted public attention to this serious problem. At the outset it should be remembered that it is the use of such water for drinking purposes without purification that is the cause of so many deaths, and that the sewage problem has become acute on account of the failure of communities to realize their responsibilities in that direction. The problem has two phases, viz.:—

(1) The immediate economical aspect.

(2) The ultimate ideal aspect.

The former, which will be dealt with first, resolves itself into a 'laissez faire' policy, the arguments in its favour being as follows:—

(a) It is less expensive to purify the water supply of a community taken from a navigable river than to purify the sewage discharged into it. The volume of sewage of a city drained on the combined system is invariably in excess of the water consumed, and since the sewage contains one thousand to ten thousand times more bacteria it is obvious that more purification is required and that the process will be more costly. (When I say the volume of sewage is greater than that of the water

supply, I do not mean the dry weather flow, but dry weather flow together with the storm water.) If the separate system of drainage is used the sewage purification will be less expensive than on the combined system but much greater than the cost of water purification. The figures that I have for water purification on this continent vary somewhat from \$6 to \$10 and \$11 a million gallons, and the cost of purifying sewage is probably between \$11 and \$15.

*By the Chairman:*

Q. You mean the cost of sewage treatment?—A. Yes.

(b) The cost of purifying water for drinking purposes depends upon the physical characteristics and not, within reasonable limits, upon the bacterial contamination, so that if the contamination is doubled there is no material increase in the cost of treatment.

(c) Modern systems of sewage purification are very expensive and no material is produced which is of value. Sewage purification would also involve the enlargement of the sewers to such a degree that their capacity would be sufficient to carry all storm water. It would be absurd to allow storm sills to be inserted to operate at ten or any other number of dilutions of the dry weather flow and discharge unpurified sewage into the streams. If the sewage is noxious when diluted with ten or fifty volumes of river or lake water it is equally so when the diluting fluid is rain water and it would be inconsistent to allow the latter to be discharged when the former is regarded as objectionable. This presumes that it is possible to make the sewers large enough to take the whole of the storm water. One storm in Toronto had a rainfall of  $\frac{1}{10}$ -inch in five minutes; this is equal to 86,100 cubic feet per second for the 17,000 acres occupied by Toronto. The normal dry weather flow is only about 70 cubic feet per second so that the sewers would require to have a capacity equal to 1,000 times the dry weather flow. I think you will agree that this would be impracticable. Either the bulk of the storm water must be provided for by a separate system or the principle of dilution admitted.

(d) There is no evidence of accumulation of sewage pollution in the navigable waters in this country.

The large increase in the combined chlorine content of Lake Ontario is regarded by some as evidence of this and by others as merely indicating an increase in the sewage pollution from year to year. Neither of these views are in accordance with the facts. The chlorine content of Lake Ontario has increased from three parts per million to nine parts per million during the last sixty years. The sewage of a large city like Toronto contains one hundred parts per million of combined chlorine but the volume is so small compared to that of the Niagara river that the increase in the chlorine content due to this sewage could not be determined. As a matter of fact if the sewage of the whole population of Canada and the United States drained into the Great Lakes, it would not increase the combined chlorine by more than four parts per million.

*By Mr. Crocket:*

Q. What do you mean by chlorine content?—A. It is really common salt, or, other compounds containing chlorine. One of the chemical methods for determining the purity of water is by ascertaining the amount of chlorine in the water. The chlorine in Lake Ontario has increased very considerably in the last sixty years. Some regard this as indicating an increase of sewage pollution, but it does not mean that at all.

Again, the combined chlorine only constitutes  $\frac{1}{4}$  of the mineral matter of sewage, so that, other things being equal, the mineral matter in Lake Ontario ought to have increased by twenty-four parts per million. There is no evidence of any increase whatever, the total solids being practically the same in 1912 as in 1853.

Q. What would that amount to in gallons?—A. Three parts per million are equivalent to thirty pounds per million gallons.

Q. How many parts in 1912?—A. Total solids about 150 parts per million and the chlorine about 8.

*By Mr. Edwards:*

Q. How do they arrive at that?—A. Simply by evaporating a certain quantity of water and weighing the residue. I took my own results obtained in Toronto in 1912 and compared them with those obtained in Cleveland during the last 50 years.

*By Mr. Crockett:*

Q. Do you measure the impurity of the water by the percentage of the solids?—A. No not the impurity, but it is a useful determination to have, by which to check up other things. The explanation of the chlorine increase probably lies in the exploitation of salt and oil on the western shores of Lake Erie. I have here the figures of Dr. John A. Amyot, in the American Journal of Public Hygiene, August, 1909, page 473 (See Exhibit No. 2, in appendix). He gives the chlorine content of the different lakes. At Port Arthur it was 1; at Sault Ste. Marie it was 1; at Kincardine 3; then coming down to Lake Huron it was 3 at Goderich, Sarnia 3, Courtright 4, and as soon as it gets to Windsor it jumps up to 8. There is the whole explanation; the salt fields and the exploitation of oil.

*By Mr. Edwards:*

Q. Are we to understand that the proportion of the chlorine is an indication of the disease producing properties of water?—A. Chlorine as a rule indicates sewage. Some people think that because the chlorine content of Lake Ontario has increased enormously the sewage pollution has correspondingly increased, but I am trying to point out that it does not mean that: that other things contribute to the increase in the chlorine content.

Q. So we need not attach any significance to the figures of chlorine as regards sewage pollution?—A. No, none whatever. To continue my statement:

(e) Whilst water purification can be adopted at any time by individuals and communities the prevention of pollution is dependent upon individual communal and international co-operation. Each individual and community at present, can get a safe water supply at any time and is not dependent upon anyone else whereas if no system of water purification is installed the safety of the stream is the strength of the weakest link in the chain of towns above it and over which it has no control.

That is to say, if you want to give a town on the borders of a lake or stream, pure water, every town whose sewage is emptied into that lake or stream above it must have a thoroughly sound system of purification. The safety of that town depends upon the least efficient town, and if several towns were turning out thoroughly good sewage, yet one was very bad, the effect of the efficient towns is considerably nullified.

(f) The prevention of pollution by legislation is too uncertain in practice to give any hope of obtaining water from navigable streams sufficiently pure for drinking purposes. This is the general experience in every country.

We come now to the other aspect of this problem. If the sewage pollution of navigable waters is allowed to continue and the population continues to increase, a stage must ultimately be reached when they become impossible as a source of domestic water supply and finally a nuisance. The small rivers of England have long ago ceased to be regarded as sources of drinking water and present efforts are along the line of nuisance prevention. The larger rivers after rigorous purification are still being used for domestic purposes but the tendency is to abandon them in favour of unpolluted sources. I do not know of a single town or municipality in the north of England taking its drinking water from rivers.



*By Mr. Chisholm (Inverness):*

Q. Where do they get it?—A. From the hills and moors. In the south of England the rivers are larger, but so far as I know the Thames and the Severn are the only two rivers which are being used for drinking purposes. Worcester, Hereford and Gloucester take their drinking water from the Severn and London takes its water from the Thames.

The ideal would be to have a stream that could be used promiscuously as a source of drinking water without purification of any description. Would restoring the rivers and lakes to the state of virgin purity so often referred to, accomplish this? In my opinion it would not. And this implies that the rivers and lakes are not naturally all that is required for a domestic supply. The past generation and a portion of the present one do not regard the presence of large quantities of silt and colouring matter as objectionable, but the demand for a clear, colourless, and odourless water is growing daily, and it is safe to predict that in the future these æsthetic qualities will become essentials. The majority of the navigable waters in this country do not at all times possess these attributes and to produce them some system of purification is required.

I will give you two examples—Lake Ontario and the Ottawa river. The Ottawa river, as you all know, is slightly coloured at all times of the year, and as winter approaches the colour increases. In the springtime the floods bring down large quantities of silt, which render the water objectionable. Take the case of Toronto in the winter and early spring months especially. The amount of silt brought up by an easterly breeze is enormous. The water is more like milk than water, and some system of purification has to be installed to remove those objectionable features.

At this point it would be advisable to state clearly what are the objectionable features of rivers and other navigable waters in this country. They are the presence of:

- (1) Human sewage.
- (2) Animal sewage.
- (3) Trade waste.
- (4) Silt and vegetable stain.

The human sewage and trade waste vary but little in volume from day to day and are constantly present, whilst the others vary enormously and depend upon circumstances over which you have no control.

If the word pollution is to be used in its general sense, all four of the above are polluting influences but for all practical purposes it is advisable to confine the term to the first three. In the present state of biological science it is believed that specific infection, *i.e.*, the presence of disease producing organisms can only be derived from human sewage but it is also possible that trade wastes may contain substances injurious to health. Whilst there is no direct evidence that animal excreta contains pathogenic organisms, it does contain large quantities of readily exidisable matters that consume the dissolved oxygen of the water into which it is discharged, and reduce its power of self-purification. When the dissolved oxygen content of a water is reduced by faecal or other polluting matter beyond a certain point objectionable odours are produced, excessive algæ growths arise, and the water can no longer support fish life; in other words, a nuisance is created. Trade wastes, as mentioned before, may contain chemicals injurious to health, but this is very rarely the case, and they are usually objectionable on account of their liability to produce a nuisance.

You have therefore two points to consider. The prevention of access to waters of—

- (a) Disease producing germs or pathogenic organisms.
- (b) Substances liable to produce a nuisance.

Of these the former are undoubtedly the more important because these organisms can retain their vitality in water for considerable periods of time and research

has shown that, generally speaking, the purer the water the greater the vitality. The work of Dr. Houston of the London Metropolitan Water Board has also shown that the vitality of typhoid organisms is greater in cold water than in warm, a fact that is of the greatest importance in this country where the navigable waters have a temperature under 40° Fahrenheit for at least five months in the year.

The important factors in the second point, i.e., regarding nuisances, are the concentration and volume of the liquid in relation to the volume of the stream into which it is discharged. It is obvious that there is less danger of a nuisance being produced by the discharge of a liquid into a fast running stream of large volume than into a lake in which the currents are dependent upon wind conditions. It is undoubtedly a fact that sewage and trade wastes can be treated in such a manner as to render them relatively free from both pathogenic organisms and substances capable of putrefaction. The details of such measures must depend upon local conditions but they usually consist of sedimentation and filtration followed in the case of sewage by chlorination. It is possible by chlorination alone to destroy all the pathogenic bacteria but the evidence regarding the non-putrescibility of chlorinated raw sewage is inconclusive and should not be accepted without further proof. This also involves the use of large amounts of chlorine, an excess of which might be very injurious to fish life. I have seen several cases of that. In the north of England it is a well known thing for poachers to put in a few pounds of bleaching powder in the stream up above where they wish to catch fish with nets. Another case I should like to mention is the city of London. London takes its water from the River Thames and the River Lee. To reduce the pollution of the River Lee, they have taken over a certain sewage works in that district, and to reduce their pollution they are chlorinating the effluent. At the point where the effluent from these works runs into the Lee, you can see the fish die. There is always the danger of that.

*By Mr. Murphy:*

Q. You spoke about some experiment of Dr. Houston's which resulted in showing that there was a greater danger in discharging sewage into cold water than into warm water. What degree of cold did this mean?—A. I think he found the vitality of the typhoid organism was about ten times as great at a temperature approaching the freezing point of water as it was at about 60° Fahrenheit.

*By the Chairman:*

Q. That means it could be carried for miles and miles down a river?—A. There is evidence that the sewage pollution of a town was carried 90 miles and caused an epidemic of typhoid.

Mr. WARNOCK.—It stands cold storage very well.

The WITNESS.—I think you will all agree that since sewage and trade wastes can be rendered comparatively innocuous it is desirable that steps should be taken to make such treatment compulsory, but in my opinion it would be ephemeral and futile to attempt to produce an effluent that would conform to a drinking water standard. The safety obtained by such an attempt would only be comparative, never absolute, and since meteorological and topographical conditions produce in most rivers and waters physical conditions that necessitate the purification of water supplies it would be inadvisable to attempt to relieve communities of the responsibility of such work.

Assuming that you agree that it is desirable to insist on the purification of discharges into navigable waters, the next step is to determine the standard of purity required and what body it is desirable to invest with the authority necessary to enforce such a standard. The latter point is one upon which I am diffident in expressing an opinion, and the only suggestion I would make is that the authoritative body should

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have at its disposal the advice of men with practical experience of sewage disposal. For the former I would suggest the following as a tentative standard:—

Albuminoid ammonia, 1.0 part per million.

Oxygen absorbed from dilute permanganate in four hours at 80 degrees F. 10.0 parts per million.

Bacillus coli, 50 per cubic centimeter.

This standard is one that ought not to be difficult for sewage and other works to conform to and which I think would be satisfactory from your point of view. Before fixing any standard it would be advisable to obtain specific evidence on this point.

The standard I have suggested here is not the standard suggested by the Royal Commission on Sewage Disposal. The standard they suggest is not endorsed by the majority of the people in England who have had practical experience in sewage purification or the prevention of sewage pollution. I think the authorities under the Rivers Pollution Act of 1876 are unanimous in agreeing that the standard set down by the Royal Commission is not a satisfactory one.

*By the Chairman:*

Q. What is your idea of the condition of the Ottawa river at the present time?—

A. The Ottawa river at the present time is one in which there is a small amount of sewage, but the dilution is enormous. Take the typhoid rates of certain cities, and you will find that if the sewage pollution of their drinking supply is large they have a very excessive typhoid rate. Cities that have an intermittent sewage pollution, and those in which the dilution of the sewage is very great, have a typhoid rate somewhere between ten and twenty, which must be regarded as high. Cities that have drinking water above reproach have a typhoid rate below ten per hundred thousand.

Q. How do you account, Mr. Race, for the fact that there was a severe outbreak of typhoid in Hawkesbury, which Dr. McCullough ascribed as due to the sewage of towns further up the river?—A. I think there is no doubt about the possibility of that. There is another case specified in Rockland. That is another example of the typhoid organism probably having greater vitality in the cold water. The water was cold at the time when the epidemic commenced.

*By Mr. Steele:*

Q. Ten days ago the ice of Lake Timiskaming was just breaking up, and I believe there are some 15,000 or 18,000 people in the Cobalt district whose sewage is being deposited in Lake Timiskaming. Would there not be a considerable danger at this season of the year of the water supply of municipalities on the Ottawa river being contaminated from that source, especially if any typhoid existed in that region?—A. There is a possibility, but it is very small at that distance.

*By Mr. Murphy:*

Q. How do you account for the fact that while both Ottawa and Hull draw their drinking water from the Ottawa river there was an epidemic of typhoid in Ottawa and none in Hull?—A. The infection of the Ottawa drinking supply during the last two epidemics was local. But that does not prevent the possibility of general infection.

*By the Chairman:*

Q. Do you consider the Ottawa river water in its present condition fit for use?—

A. I do not regard it as a safe drinking water supply, no matter where you take it from. Suppose you take the typhoid rates in both Hull and Ottawa, and omit the epidemic years from both, you have still an excessive rate, in most cases over fifteen per hundred thousand.

*By Mr. Crocket:*

Q. You say the pollution so far as Ottawa is concerned is local. What do you mean by that?—A. The infection of the water supply was local; it did not come from the river in general. It was local sewage pollution, and it entered the supply through a defective pipe.

*By the Chairman:*

Q. You mean from Nepean bay?—A. I should not like to specify the place; it is not proved yet. It is more probable that it was infected in the aqueduct than in the bay.

*By Mr. Steele:*

Q. Do you say the evil is due to pollution from Ottawa and Hull?—A. I mean above the Chaudiere falls.

Q. Do you refer to the water generally?—A. Oh, yes, the water generally.

*By Mr. Murphy:*

Q. Did you hear Mr. White give evidence this morning?—A. Yes.

Q. Did you agree with what he said as to the result of tests made by the Commission of Conservation as to the cause of the typhoid epidemic?—A. The report said that it was due to a valve being open; but I think if you put the same question to Dr. Hodgetts when he appears before you he will modify that opinion, and say it was probably due to pollution in the aqueduct.

*By Mr. Crocket:*

Q. Does the treatment of the water with hypo minimize the danger of typhoid?—A. Undoubtedly, wherever hypochlorite is used there has been a large reduction in the typhoid death rate.

*By Mr. Murphy:*

Q. Have any tests been made as to the purity of the water in the Gatineau lakes?—A. Yes.

Q. Who made the tests?—A. I did.

Q. What do they show?—A. At present, the water up there is very suitable from every point of view.

Q. To which lakes do you refer?—A. I am referring now to White Fish, Pemi-changaw and Thirty-One Mile lakes.

Q. Were there any bacteria at all?—A. Just a few.

Q. Did you make tests of any other lakes?—A. Just in a few small ones, Cat Fish and Victoria lakes.

*By Mr. Alguire:*

Q. Did they show disease-producing bacteria?—A. No, none of them. A question was asked a little while ago as to whether tests of Lake Ontario water had been taken at different depths. There were samples taken at depths of 50 and 60 feet, and some at the surface. The evidence was not conclusive. In some cases they found the deep water sample worse than the surface sample at the same spot. In other cases it was just the reverse.

*By the Chairman:*

Q. Is that due to contamination?—A. It is possibly due to pollution flowing out of the gaps and not mixing up.

*By Mr. Murphy:*

Q. What about the hardness of the water in the Gatineau lakes?—A. It is a little higher than in the Ottawa river, but not much.

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*By the Chairman:*

Q. What is your opinion regarding the whole question of the prevention of the pollution of streams?—A. I think that all sewage pollution and trade wastes ought to be prevented from running into the rivers unless thoroughly purified. The whole question is whether you are going to try to destroy disease producing bacteria or not. It is not merely a question of the prevention of nuisance. Are you going to stop there, or try to compel people to produce an effluent which is not dangerous? You can do the one without the other.

Q. Do you think it possible, take the city of Ottawa, for instance, to put in a plant here by which we could treat our sewage effluent so that it would not be injurious to any of our neighbours down below?—A. If you were to put in a plant to treat the sewage of the city of Ottawa so that it would not create a nuisance to your neighbours below it might still be just as dangerous as it is at the present time, because making the sewage effluent free from putrefying material does not take away the disease producing organisms at all, that requires a different treatment altogether.

Q. But they can be removed?—A. They can be destroyed by chlorine.

Q. If this bill is passed would it not entail a very much greater expense upon the municipalities?—A. Suppose it takes, say, for the sake of argument, ten dollars per million gallons to produce an effluent that would not create a nuisance to our neighbours below, for another \$2 or \$2.50 you could make it free from disease producing organisms.

Q. And that is well spent money?—A. I think so.

*By Mr. Steele:*

Q. There is another phase of this question that should be considered. Take a part of Western Ontario in which there are many large towns situate on inland waters that run through farming districts, and which are utilized by the farmers to water their cattle. You can understand that a town in drawing its water supply from the river for domestic purposes can purify that water if necessary, but it cannot be treated in that way when used for cattle. That is a danger in addition to what we have been discussing, and I understand this bill applies to all waters.

The CHAIRMAN.—To all navigable waters or to waters that flow into navigable waters, which will cover all waters in Canada?—A. So far as I am aware there is no evidence that cattle can obtain any disease from drinking polluted water. I do not know of any evidence to that effect at all.

*By Mr. Steele:*

Q. Except that dairymen think they must have pure water for their cattle?—A. I do not think it is altogether that; the dairyman should undoubtedly have a supply of pure water on his farm, not necessarily for his cattle but for cleansing the utensils, that is the danger.

*By the Chairman:*

Q. Then your argument is that no matter what the animal drinks it wont effect the milk?—A. I never heard that it did, except in the case of anthrax. The point is this that enteric fever, especially typhoid, is not a disease which is known to cattle.

Q. Do you agree with other scientists that typhoid is a water borne disease almost entirely?—A. Not almost entirely, but a large proportion of it is.

Q. You believe that it is a disease that is preventable?—A. Yes, certainly.

Q. What percentage is preventable by legislation?—A. I should say at least 75 per cent.

Q. Then according to your statement your opinion is that if we had proper sewage protection in the city of Ottawa we would have had at least 75 per cent fewer typhoid cases and deaths during these epidemics?—A. Undoubtedly.



*By Mr. Crocket:*

Q. It would have prevented the epidemics altogether?—A. Oh, yes, there would have been no epidemic. Another point is that the more cases of typhoid you have in one year the more danger there is of an increased number in the following year, and the smaller the number of cases to which you can reduce it in any one year the next year you will possibly reduce it still further.

Witness discharged.

Committee adjourned until Tuesday, 13th May.

TUESDAY, May 13, 1913.

The Committee met at 11 a.m., the Chairman, Mr. Bradbury, presiding.

Dr. W. T. CONNEL, of Queen's University, Kingston, sworn.

*By the Chairman:*

Q. You are connected with Queen's University?—A. Yes.

Q. What position do you hold?—A. I am Professor of Bacteriology and Hygiene.

Q. You have given considerable study to the pollution of waterways?—A. Yes, that is one of the important branches of the work which comes before me.

Q. Will you give a statement of conditions as you understand them? If you have prepared a written statement, you might read it.—A. Unfortunately, I did not. I was only notified on Thursday last, and I have been unable to make a memorandum for presentation. But I shall be very glad to discuss the matter as it appears to me.

Mr. EDWARDS.—I would suggest that we let Dr. Connel present his views as seems best to him; and if the members wish to ask questions they can do so later on.

The WITNESS: I have read the Bill which is now under consideration, and I think some such Bill is a necessity, especially with our growing population. In the case of most of our cities on the large lakes and great rivers, like the St. Lawrence and the Ottawa, the danger from the discharge of their sewage untreated is primarily to the people of these cities and towns themselves: that is when these lakes and rivers are the sources of their water supply. For instance, Toronto pollutes its own water; Kingston pollutes its own water supply; and I think Ottawa has been responsible practically entirely for the pollution of its own supply. The danger to other cities and towns will depend upon a number of factors, such as the size of the lake or river under consideration when considered in relation to the amount of sewage discharged into it—because dilution is rather an important point in lessening the immediate danger from such sewage. This point I will return to later. I am better acquainted with the conditions in Kingston and its neighbourhood, because nearly all the investigations I have personally made have been confined to that locality. Kingston, a city of practically 20,000 people, discharges its sewage into the harbour all along the water-front. It takes its water supply from the harbour half a mile from shore, apparently from beyond the usual course of the currents. We find, however, that even in that distance, with certain kinds of winds from the northeast, the water at the intake becomes polluted; that is, we can detect pollution there. We can also follow the sewage of Kingston down for about 14 or 15 miles. But our index of pollution which we bacteriologists set is the detection of the bacillus coli in the

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water. Now, while one can find within a hundred or two hundred feet of the Kingston docks bacillus coli present in every cubic centimetre of the water, as we go further out we find that that gradually lessens, till at the intake it is exceptional to find it unless we examine quantities like 50 cubic centimetres, or even 100. If we go down the river, we find like conditions requiring 50 or 100 cubic centimetres for detection, and finally it disappears. About 14 or 15 miles down the stream you will find bacillus coli in 100 cubic centimetres in about 50 or 60 per cent. of the samples.

*By the Chairman:*

Q. You say that fifteen miles down the stream you can still detect pollution from Kingston?—A. Yes; and Kingston is only a city of 20,000, and there is an immense volume of water flowing down the river. But the presence of bacillus coli does not necessarily mean that that water is very dangerous. The colon bacillus is not in itself a disease-producing organism. It is taken as a standard of pollution, because it is a bacterium which is constantly present in the bowel contents of man, and one which is rather readily detectable, and which, of course, would be present if disease-producing bacteria were thrown out from the intestines. Now, the question has often been present in connection with the mixed sewage of cities or towns as to the proportion of bacillus coli to actual disease-producing bacteria, and while we have no figures that are exceedingly definite, I think that we can say that there are at least 500 bacillus coli to one typhoid bacillus thrown into the water. So the finding of the one colon bacillus in 25 or 50 cubic centimetres of water, if this proportion would hold, would mean that you would have to examine quite a bulk of water to get typhoid, and the danger from typhoid depends to a certain extent upon the dose you get, the larger the dose, in other words, the more certain you are to develop the disease. Of course, under special circumstances the typhoid bacilli might be much larger than the proportion stated.

*By Mr. Edwards:*

Q. Do I understand you to say that the presence of colon bacilli is not an indication of water purity?—Exactly. If the colon bacillus is absent, you can very certainly say that there is no bacterial pollution of the water from animal or human excreta.

*By Mr. Northrup:*

Q. On the other hand, it may be there and the water not be dangerous?—A. Quite so. Of course, that is in a small amount, e.g. in 100 c.c. of water required to detect bacillus coli. One has to take each particular case into consideration, because, besides the finding of the bacillus coli, there are other considerations.

*By the Chairman:*

Q. What quantities would you say would make the water dangerous?—A. If I find bacillus coli in 10 cubic centimetres of water at all commonly, I would say that water would be particularly dangerous and would require some treatment before being used for drinking purposes. One cannot say that water containing, say one bacillus coli in 25 c.c. was free from danger, but the danger is lessened very materially with dilution.

Q. What about danger to towns from using water polluted above?—A. I have made the statement here that on our large lakes and rivers, the danger is largely to the cities and towns themselves that discharge their sewage in their own waters. There is danger to others to a certain extent, and that depends, of course, upon the rate of flow of the stream, the bulk of the sewage discharged into it, and the time which elapses between the discharge of the sewage and its arrival at the point below.



The way that bacteria disappear from water is by lapse of time, by sedimentation, and by dilution. They die out in the course of time e.g. the typhoid bacillus usually dies in water from 5 to 8 days.

Q. You said that the pollution could be traced 14 or 15 miles below Kingston. Would you consider that the towns within that distance would be drawing water which is dangerous for consumption?—A. It would not necessarily be dangerous, in the sense of the word that if you drank it almost certainly typhoid would develop, but one or two persons of those using it might, in the course of a year, by continually drinking it take typhoid fever.

Q. If the pollution was greater?—A. The greater the pollution the greater the danger.

Q. If that same amount of sewage was poured into a small river, there would be a greater danger to the towns below?—A. Yes, because the amount of sewage would be larger there compared to volume of water, and the number of bacteria would be greater.

Q. At Kingston there is a very large volume of water?—A. Yes.

*By Mr. Northrup:*

Q. If there were typhoid fever at Kingston, would that not increase the danger of infection at the towns below?—A. I think that we can say that either typhoid fever cases or typhoid carriers are constantly present in every town and city, hence that a certain number of typhoid bacilli are being daily discharged with untreated sewage into the rivers and lakes by practically every town and city in this country.

Q. If there were anything of an epidemic, of course that danger would be increased?—A. Provided the excreta were not disinfected, as they are supposed to be by law.

Q. I have not every confidence in the execution of those laws myself?—A. I may say that my experience has been with the typhoid outbreaks in Kingston, that typhoid practically does not appear in anything like what may be called epidemic or sub-epidemic form unless bacillus coli appears in the water so as to be detectable in amounts under 10 cubic centimetres, and when it is present and is detectable in 50 per cent of samples in one cubic centimetre the danger becomes very great. That has been our experience in the epidemic of 1903, and the smaller epidemics we had in 1909 and 1910 in Kingston.

*By the Chairman:*

Q. What do you attribute those epidemics to?—A. Undoubtedly to water infection.

Q. . Would you say that typhoid is a waterborne disease, as a rule?—A. The majority of cases I think are, unless an epidemic has broken out. Then there are always a number of contact cases. Probably after the first outbreak there are as many contact cases as occur with the first outbreak; thus if there are a hundred persons taken down with typhoid there will be a hundred others infected by contact: I mean by coming into contact not simply entering the room, but getting the bacilli from the excreta on their fingers in nursing, or handling soiled linen or bedding and carrying them directly or via food to mouth, or by carriage of the bacilli by flies to food in the house.

*By Mr. Steele:*

Q. Will you explain the conditions in water which would reduce the typhoid to a lower point in the stream. For instance, you spoke of the currents, of sedimentation, &c., will you explain that in detail—whether a rapid current or still water would be the most likely to cause or reduce infection?—A. Still water allows sedimentation, allows the deposit of all particles and thus the contained bacteria gradually settle

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to the bottom. The more rapid the current is the more it keeps the water stirred up and the organisms are carried a greater distance.

*By Mr. Northrup:*

Q. Niagara Falls city would be an illustration of that. I understand that Buffalo sewage has raised the typhoid fever rate there phenomenally?—A. I understand—not from personal observation—that you can detect colon bacilli as a rule in one cubic centimetre of water at the mouth of the Niagara river, a very heavy pollution indeed. It means that Buffalo and the smaller towns on the Niagara river discharge their sewage into this rapid current, and no time is allowed for purification. It is hurried to the mouth of the river.

Q. That is the result of the swift current in the river which carries it along.

*By the Chairman:*

Q. Your argument is that in a slow moving stream there is more danger to the places below which derive their water supply from the same source?—A. Not at all, it is just the other way around; the quicker the current the more rapidly the sewage is hurried to the places below, and in more dangerous form; the more recent the sewage the greater the danger.

Q. That is what I say, the danger is from the rapidly running stream more than from the slowly moving one?—A. Quite so.

Q. With a slow running stream greater sedimentation takes place between the two points?—A. It tends to purify itself, by sedimentation and lapse of time.

*By Mr. Kyte:*

Q. What would you say, Doctor, as to the effect the continuous use of the chloride treatment that the Ottawa water has been subjected to has upon the people?—A. In reducing the danger?

Q. Yes?—A. Chloride properly applied undoubtedly destroys the pathogenic bacteria in the water, and with that destruction it reduces the danger to a minimum from the use of that water.

Q. Is there anything in that treatment of the water which makes it injurious to the individual by reason of the treatment with chloride?—A. No, not if properly applied; the hypochlorite itself is practically destroyed in the process, and is transformed into a harmless substance.

Q. How do you account for the fact that sometimes in the city of Ottawa the water when the chloride has been applied is in such condition that you could not drink it?—A. That is because they are using enormous quantities.

Q. Do you not think that would be injurious?—A. If you had free chloride in it undoubtedly it would be, but we give as medicine doses of chlorine far in excess of what is in the water.

Q. But not continuously?—A. Oh, not at all.

*By Mr. Baker:*

Q. If it is not injurious, how do you account for the report that animals, birds, cats, dogs and fish have died from using the city water?—A. I can account for the fish dying, but I cannot understand how the other animals would die from the use of such water, that is if they do so. The fish would die because of the chlorine using up the dissolved oxygen in the water.

*By the Chairman:*

Q. Can you determine as to whether the pollution in the water is from new or old sewage?—A. Not definitely, we cannot say whether it is from the new or comparatively old sewage; if you used as the index of pollution the presence of the colon

bacillus there is no telling whether it has passed from the body within an hour or within two or three weeks.

Q. Now, take the case of a slowly moving stream: I have in my mind the Red river at Winnipeg; we have built a large dam twelve miles below Winnipeg, which has created a large body of still water, and all the sewage of Winnipeg, Portage la Prairie, Brandon, and towns south of the boundary is running into the Red river. All that sewage is being poured into that basin where sedimentation is taking place all the time and I can understand that the pollution from the old sewage in the fall of the year, when they raise the stop-logs to allow the water which has been raised 21 feet in the summer time to run away, would be very great; that old sewage has been shut up all the summer in that basin and when it is allowed to flow down the river would it not carry very dangerous pollution to the points below?—A. Not at all, you will find that the life of the typhoid bacillus and colon bacillus is rather limited; I think I can say that the life of the colon bacillus is generally under three weeks, though possibly under certain circumstances it may live a little longer, especially in the mud sediment; the bacillus seems to settle in the mud and lives there a little longer than ordinarily; the cooler the temperature, too, the longer this organism will live; they live longer in the winter than in the warmth of the summer.

Q. Your argument is that sewage deposited in a body of water of that kind will not, two or three months afterwards if it is stirred up contain an element of danger?—A. Not at all, the typhoid bacillus will certainly be dead; typhoid dies out much quicker than colon bacillus.

*By Mr. Northrup:*

Q. Have you any practical suggestions to make to the committee as to what should be done under ordinary circumstances? That is what this committee is anxious to know—what should be done? I suppose every locality has its own peculiar conditions and it would not be possible to make any specific suggestion which would cover all localities? But speaking generally would there be any suggestion you could make which would be applicable?—A. Every city should treat its own sewage in such a manner as to render it harmless to any other cities or towns which may take their supply from below.

Q. And harmless to itself also?—A. Of course, to itself, the selfish reason would apply first. As I have said, I think our own experience has been that the danger is very largely to one's own town first, and secondly to those below, and so for purely selfish reasons we should treat our sewage and thus not injure ourselves, and secondly, to injure others.

Q. What is the most effective treatment you can suggest?—A. That depends so much upon the locality; you cannot lay down any definite statement which will apply to all localities; each locality has to be studied, it is a problem in itself.

Q. One place is built upon rock and another place upon sand?—A. Quite so.

*By Mr. Béland:*

Q. You belong to Kingston?—A. Yes.

Q. Of course you are conversant with the conditions and currents there?—A. Yes.

Q. What would be the approximate cost of a proper plant for the treatment of the sewage of Kingston, you know the population and have all the data necessary to give an estimate?—A. I could not answer that definitely because Kingston is on a limestone ridge, and the cost of putting in intercepting sewers and collecting the sewage for treatment is an item that would loom up very largely in any question of cost. It is all rock excavation that would have to be made, and then the city being very much spread out and on a point, the question comes up whether it would not require at least two, or probably three, sewage plants to handle the sewage, unless a

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pumping station were installed to pump the sewage. These are engineering problems and I am not sufficiently acquainted with such to make any definite statement as to the cost.

*By Mr. Northrup:*

Q. Would the place of treatment of the sewage if such a system were adopted necessarily be a nuisance to the people in the neighbourhood?—A. As a rule you cannot treat the sewage without creating some little nuisance in the immediate locality.

Q. Would there be any nuisance created by a properly managed plant?—A. There is in a properly managed sewage disposal plant not a great deal of odour, but still there is always some odour emanating from it, to which people in the neighbourhood object.

MR. NORTHURP.—I do not see why the Ottawa people should object to a sewage disposal works when they allow livery stables to exist on some of the most prominent streets here.

THE CHAIRMAN.—And we have the odour from the sulphite plant across the river.

*By the Chairman:*

Q. Have you examined the water further down the St. Lawrence river than Kingston?—A. Not systematically. I have examined the water at Brockville and Prescott very frequently; that is, largely their tap waters and those taken from their intakes and in both these towns we occasionally find the presence of the bacillus coli in their waters. In both these towns I believe the infection is due to local causes.

Q. If I understand it aright the water you have examined in the St. Lawrence is polluted?—A. Yes, taking the bacillus coli as the index of pollution the waters I have examined have been so frequently infected with bacillus coli that sewage pollution to a slight extent at least may be the rule. I might add for the information of the committee that the water at the foot of Lake Ontario, that is a few miles above Kingston, practically never show the bacillus coli, when examined in 100 centimetres and even up to 100 cubic centimetres; that is it is practically pure water bacteriologically.

*By Mr. Kyte:*

Q. What is the distance from Kingston to the outlet of Lake Ontario into the river?—A. It is usually considered to be nine miles up at what is called 9 mile point.

Q. When speaking of the pollution having been discovered 14 miles from Kingston, that is, of course, down the river?—A. Yes, down the river at the foot of Wolfe island.

Q. What is the distance across the river at Kingston?—A. Lying in front of Kingston, about two miles from the mainland is Wolfe island which runs from a point 6 or 8 miles up to 14 miles below the city. It was at the foot of this island that samples were taken which showed colon bacilli, when tested, in very large quantities, such as 25, 50 and 100 cubic centimetres.

*By Mr. Edwards:*

Q. Have you gathered any information, doctor, from Lake Ontario or Lake Erie which would indicate to what extent out from the shore of the lake the sewage was liable to affect the purity of the water?—A. My information of course would have to be taken from the official reports of the Provincial Board of Health and other health bodies; and in the reports of the Provincial Board of Health of Ontario, it is stated that they have discovered evidence of pollution by the Toronto sewage 15 and 20 miles from the city.



*By Mr. Northrup:*

Q. That would indicate that the whole of the lake is polluted?—A. No. My own personal experience has been confined to the lower end of the lake and there, as I have already stated, the water was pure when tested, in samples of 100 cubic centimetres and even in 1,000 cubic centimetre amounts.

*By the Chairman:*

Q. How far is that from Toronto?—A. It is 160 miles from Toronto.

Q. Is that difference in result caused by the water becoming purified in its passage down the lake?—A. The reason for the good results found is the marked dilution and the enormous sedimentation basin which the lake provides, also the lapse of time, many days being required before the water could possibly work its way down from Toronto and Rochester to Kingston.

*By Mr. Edwards:*

Q. The point is as I understand it, in view of what you have stated regarding the extent to which pollution has been found to exist, that in all cases where cities or towns along the lake front or the river get their water supply from the lake or river, into which sewage is discharged, the water in the lake or river may be regarded as impure or unfit for domestic use unless treated?—A. Yes.

Q. What is the remedy?—A. Cities will have to treat the sewage and also the water.

Q. If they want to be perfectly safe?—A. Yes.

*By Mr. Northrup:*

Q. In reference to your statement that pollution has been found 15 or 20 miles out in the lake from Toronto, I observe that city is entertaining a proposal to get its water supply from Scarboro which is only a few miles to the east, and as the drift of the water in the lake is in that direction would not that be perilously near the source of pollution?—A. Toronto is installing a sewage treatment plant, I am not sure whether it is in working order or not, which will rob their sewage of its dangerous qualities. I do not know anything about the currents in that part of Lake Ontario.

Q. It struck me that if pollution had been found 15 or 20 miles out in the lake it would affect their water supply if that were located at Scarboro.

*By Mr. Béland:*

Q. At this point where evidence of pollution was found 14 or 15 miles from Kingston, what was the width of the river?—A. It is over 2 miles wide there.

Q. You have an idea of the size of the St. Lawrence river at and below the city of Montreal. You know the population of Kingston and the size of the river there, and taking these facts into account you find the bacillus coli fourteen to fifteen miles below Kingston. Now take the case of Montreal with its population and the breadth of the St. Lawrence there, how far below the city would the water be infected?—A. Have you any lake expansion below Montreal?

Q. Not below Montreal?—A. The lake expansions are all above Montreal?

Q. Yes, all above Montreal?—A. I fancy you would find the water contaminated for a distance of sixty or eighty miles below Montreal if systematic investigations were made.

*By the Chairman:*

Q. What is your opinion of chlorine as an indicator of sewage pollution?—A. As compared with bacillus coli it is an exceedingly poor indicator. For example, in connection with our city water a number of tests were made along the course of our

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water pipe and after going out 250 feet from the shore as far as the chlorine indications were concerned there was no evidence of contamination. As far as the bacillus coli was concerned, this bacillus was present at this point in two or three cubic centimetres, which was a very serious pollution. Chlorine as an indicator of pollution in large lakes and rivers, is nothing near so delicate a test as the bacterial test.

*By Mr. Béland:*

Q. I understand you to declare that when the bacillus coli is absent from the water there are no dangerous organisms present?—A. I think it is perfectly true that we can say that no dangerous disease producing bacteria can be present in the water, that is disease producing bacteria arising from sewage pollution.

*By Mr. Northrup:*

Q. Then the presence of the bacillus coli serves as a sort of stormy petrel?—A. Yes, it is an indication of sewage contamination.

*By the Chairman:*

Q. What would you say as to the necessity of municipalities in cities and towns providing sewage treatment plants for the protection of their water supply. Do you consider it is in the interest of the health of the people of Canada that some such system should be provided?—A. I certainly do. I think that cities and towns should so treat their sewage as not to be a danger to themselves or other communities below them.

Q. Do you consider that sewage from the city of Ottawa, or other large cities, while it may not produce typhoid fever, has an injurious effect upon the health of the people who use the water into which that sewage flows? In other words, does the use of that water undermine the health of the people?—A. I think not seriously. I think that if we can say that the water is free from disease producing bacteria—that is unless one is taking sewage almost raw—that it is producing no very serious effect any more than would drinking water containing a good deal of vegetable organic matter. For example, water that drains from forest lands, or even cultivated soil, contains a good deal of vegetable organic matter, but it would not be dangerous to human health provided it were free from disease producing bacteria.

Q. You consider that water that would not produce disease or fever would not have a deleterious effect on the human system?—A. Provided that water were reasonably good in other respects. You do not want water containing a good deal of silt or sediment, or water containing an enormous quantity of organic matter, because these are apt to ferment and cause intestinal disturbance. Such water containing a good deal of silt or sediment or much organic matter, is rather upsetting to the intestinal tract.

Q. What experience have you had along that line? What experience have you had to show that contaminated water, in addition to producing typhoid fever causes serious intestinal troubles? I have heard the statement by medical men that it does?—A. You will find in almost every epidemic outbreak of typhoid, and, before its onset, that there is a history of a diarrhœal outbreak. I can very well remember in the epidemic of 1903 in Kingston, that from the records of the doctors that there were about 1,000 cases of diarrhœa, and within the usual time thereafter of the period of incubation of typhoid fever, there was an outbreak of sixty or seventy cases of typhoid fever. The typhoid fever developed about twelve to fourteen days later, showing that the presence of the sewage in the water produced these diarrhœal attacks.

Q. How long does typhoid fever take to develop after the germ has taken lodgement in the system?—A. From twelve to fourteen days, as a rule.

*By Mr. Northrup:*

Q. Take our peculiar position in Canada, with ourselves established on the north shore of the Great Lakes, the St. Lawrence and other rivers, and our American friends located to the south, what would be your idea as to the wisdom of our taking legislative action even if the Americans declined altogether to do so?—A. I have already endeavoured to point out that our danger is very largely the result of our own action in the past, that as the result of the action of our own cities and towns emptying their sewage into these lakes and rivers, we have very largely fouled ourselves.

Q. Then putting it on the lowest ground it is up to us to take action to protect ourselves?—A. Quite so.

*By Mr. Baker:*

Q. As the population of the country increases, will the danger increase or lessen?—A. It will increase with the growth of population unless proper safeguards are adopted.

Q. You think the time will come when it will be absolutely necessary for us to take some action?—A. Undoubtedly. We will be forced to do it some time if we do not do it now.

*By Mr. Kyte:*

Q. Do you know anything about the policy pursued by the United States cities on the Great Lakes? Are they discharging their sewage into the lakes in the same way that our cities are?—A. They have been quite as reckless as we have been in the past. I think some of them have become alive to the necessity of treating their sewage. Chicago is a city that has developed methods of its own in sewage treatment.

Q. I am not speaking of Chicago. I allude more particularly to Rochester and Buffalo.—A. I am not acquainted perfectly with the systems in vogue at these cities. I believe they are all considering systems of sewage treatment and that some have adopted a system, but whether they are in operation or not, and to what extent they are effective, I cannot say.

*By Mr. Northrup:*

Q. Have you any figures to show the extent to which typhoid fever prevails in this continent as compared with European countries? I have understood that our average was very much higher than European countries.—A. I have seen such figures but I have none with me at the present time. Probably Dr. Hodgetts will be able to give you that information.

*By Mr. Steele:*

Q. Have you any knowledge of the quality of the water in the streams flowing into Lake Ontario in the Kingston district?—A. Such streams in the Kingston district are very small. There is the Little Rideau, and farther up the Napanee and the Salmon river. They are all very small streams, but they carry reasonably good water until they strike the towns. For example, below Napanee, the Napanee river is pretty foul. At Belleville the bay water is analysed from time to time and the water always shows up rather badly in the tests.

Q. What are your views on sewage treatment?—A. I might say that in connection with the treatment of sewage there are two views of the matter. One would require the sewage to be so treated, or purified, that it could be turned back into the stream and would not pollute it at all. The other is that if the flow of water is at all large, as compared with the bulk of the sewage, we can destroy the disease-producing germs in it, and liquify the solid matter so that it will not produce any gross pollution. This, I think, in the case of our large streams is the most feasible and



cheapest project we could carry out in this country. To liquify the solid matter, that is remove the gross pollution and destroy the disease-producing bacteria, is not the ideal method to employ, but it is the most feasible one having regard to the cost.

*By the Chairman:*

Q. Would this method still leave the water polluted?—A. It would leave the water polluted with the organic matter in the sewage, but would destroy the disease-producing bacteria. This method, however, only applies to fairly large bodies of water. In the case of smaller bodies of water into which the discharge from the city or town enters, you would have to purify the sewage to a greater extent.

Q. Following up that question of two systems that may be adopted: one is to purify the sewage before it goes into the water, the other is to purify the water after the sewage enters it. Now, in the case of a large city like Ottawa, if you were asked what method would be the best to adopt, what would your answer be?—A. I would like to see both adopted. It is a pretty difficult matter to say just what you should do, because you have to take into consideration local conditions.

*By Mr. Baker:*

Q. Would either system render the water safe?—A. No. I think both systems are required. In the great majority of cases you would have to treat your sewage and for safety treat the water also. That is, provided you take your water from the channel into which you discharge your sewage.

*By the Chairman:*

Q. If I understand you aright, you do not seem to feel that the treatment of the sewage alone would be a sufficient protection to the public?—A. There are so many problems arising in connection with the matter which have to be considered. There is, for example, the question of the storm water and the consequent over-flowing of the sewers. No matter what methods of treatment you might follow, something might go wrong with your system of disposal so that untreated sewage would enter.

*By Mr. Béland:*

Q. Has the depth at which the water is being taken for consumption anything to do with the condition of the water itself? For instance, take a stream that might be twenty-five feet deep, and you draw your water say at a depth of twenty feet. Would the water at that depth be purer than if it were taken at a depth of only five feet from the surface?—A. As a rule it would be slightly purer, but there again it depends upon the rate of the current and the amount of mixing of the water.

Q. I asked the question because in front of the city of Quebec, between Quebec and Lévis, water is being taken for consumption in the latter city, and it is claimed that at the depth at which the water is obtained there is no danger. Of course there is a big discharge of sewage from the cities of Quebec and Lévis in that vicinity.—A. Everything depends, of course, upon the amount of admixture.

Q. So there would not be any foundation for the claim that the water would be purer by reason of the depth at which it was taken?—A. No. You would simply get rid of any surface contamination by taking the water at a greater depth.

*By Mr. Baker:*

Q. How do you reconcile that statement with your previous statement that the sediment containing the bacteria goes to the bottom?—A. Doctor Béland was referring to moving water. Of course, in a perfectly still lake the nearer you got to the bottom—



Q. The more impure the water would be?—A. Yes. In the case of all intakes the end of the pipe must be some distance from the bottom in order to avoid drawing in any of the actual sediment.

The CHAIRMAN.—Any other questions? We have two other witnesses here to give us some information. All right, thank you, Doctor. I am sure we are all very much obliged to you. We are all deeply interested in this subject and appreciate your address.

Witness discharged.

The CHAIRMAN.—I understand that Mr. White has got some papers to present, and I will now call him.

Mr. James White recalled.

Mr. White then presented the following memoranda, which the Committee had ordered to be prepared:—

Memorandum *re* Cost of Sewage Treatment. (Exhibit 3.)

Memorandum of Canadian Provincial Laws, and of some of the State Laws of the Union, on Sewers and Sewerage Systems. (Exhibit 4.)

List of the Cities, Towns and Villages, with population of upwards of one thousand, that discharge into navigable waters, sub-divided 'into fresh water' and 'into tidal water.' (Exhibit 5.)

*By Mr. Béland:*

Q. Does No. 5 include all countries?—A. No, only Canada. In connection with that, I found one difficulty, and that was where to draw the line between those places that discharge directly into tidal water and those that discharge not directly into tidal water but only a short distance from it. In some cases I included those that discharge directly into tidal waters. Another difficulty arose in connection with those rivers that might not be navigable exactly at the point where the sewage was discharged. For instance, the city of London, the town of Woodstock, the town of Stratford, all discharge their sewage into the Thames or its tributaries. That sewage, while not actually discharged into the stream where it is navigable, passes down the stream to the point where it is navigable, and I would like to have instructions from the Committee respecting the inclusion of those places in a separate list, with a note respecting their status as regards navigable waters.

The CHAIRMAN.—I think it would be very desirable to have such a list. Perhaps it would be even more valuable than the list presented, as the danger would probably be greater in such towns.

*By Mr. Northrup:*

Q. Is the Thames used by any places for drinking purposes?—A. Yes, by some of the smaller places.

The WITNESS.—Dr. Hodgetts, I understand, will hand in statistics respecting the mortality from typhoid. As regards the Laws on Sewers, the memorandum I have presented gives only some of the States. I propose now to procure some information respecting all the States that adjoin our international boundary, or that are in any way traversed by international streams. That, Sir, I think, is all I have to submit this morning.

*By the Chairman:*

Q. I suppose the men employed by the provincial governments would be able to co-operate with the Conservation Commission, in this work. In Manitoba, for in-

stance, the Public Works Department has engineers working on the rivers all the time, and I have had some data from some of these men.—A. It is the Department of the Interior that employs them. Of course, those engineers have nothing to do with water, outside the prairie provinces. In that connection, I might say that we procured from them a great deal of information in respect to another report regarding water-powers, which will, of course, also be available for the purposes of the Committee. When I was here last week, I mentioned the report of the British Royal Commission. I handed in their second report, and I have with me now their first report on methods of treating sewage. Both these reports are worded in technical language and run into a considerable number of pages. I do not think any member of the Committee would care to wade through this report, as it is so extremely technical. What I would suggest is that we prepare a digest of these two reports, giving our conclusions.

The CHAIRMAN.—I think that would be the will of the Committee.

*By Mr. Steele:*

Q. In connection with inland towns, can you give us a list of those that deposit their sewage in inland rivers but do not take their water supply from the same river?—A. We have already commenced to procure that information. It will require a certain amount of time, because we have first to circularize the various municipalities, and in circularizing we have found that there are always a number of municipalities that do not reply immediately and which have to be followed up. A number, of course, respond immediately, and a few are incorrigible, so that long before the next session of Parliament we will have all the information desired.

The CHAIRMAN.—I think that is perhaps all we want to-day, Mr. White. The Committee are very much obliged to you for gathering this information.

Dr. CHARLES A. HODGETTS, sworn.

*By the Chairman:*

Q. What is your full name?—A. Charles A. Hodgetts.

Q. What position do you hold?—A. I am Medical Adviser to the Commission of Conservation, Public Health Committee.

Q. What was your former position?—A. Before taking my present position I was Chief Health Officer for Ontario, previously to that Medical Inspector for the Province of Ontario.

Q. Can you personally outline the position of the Commission in respect to any proposed legislation regarding the pollution of waterways?—A. Perhaps I may be permitted to read a statement which I have drawn up, briefly describing the situation, which was mainly outlined by Mr. White at the previous sitting of this Committee.

The CHAIRMAN.—Yes. Read it.

The WITNESS.—Upon assuming the duties of Medical Adviser of the Commission of Conservation, the first question handed to me for consideration was the Bill introduced by Senator Belcourt, together with the Report of the Standing Committee of the Senate of Canada, dated February 18, 1910: (The Senate, as you are well aware, had been discussing this question.)

After hearing and carefully considering the evidence, your committee cannot fail to see that the public health of Canada is being considerably imperilled by the present custom of disposing of sewage, garbage, &c., into the lakes, rivers and streams of the country.

Your committee is of the opinion that the only remedy, and the only safeguard, lies in the passage of legislation to control it. The legislation to be effective

tive must be uniform throughout the whole Dominion, and can only be brought about by co-operation between the Dominion and Provincial Governments.

'It is, therefore, recommended that the Commission of Conservation, representing, as it does, all the Governments in Canada, be requested to call together the health authorities of each province to meet them in conference at an early date, and endeavour to devise means whereby this end may be attained.'

A conference of the Provincial Health Authorities was convened on October 12 and 13, 1910, when the provincial and federal health officials met and discussed the question of the pollution of Canadian waters by sewage and factory wastes and considered a draft Bill along the lines of that introduced by Senator Belcourt. The report of the Conference was as follows:—

'Your committee on the pollution of interprovincial and international waters begs leave to report that

'Whereas, the pollution of the waterways of the Dominion by raw sewage and factory wastes is a menace to the health of the public generally by reason of the contamination of public water supplies as indicated by the excessive mortality from enteric (typhoid) fever alone, and by the evidence taken and the report made by the Public Health and Inspection of Food Committee of the Senate of the Dominion of Canada;

'And whereas, the maintenance of the permanent purity of public water supplies is a matter of national importance affecting as it does every citizen, whether a resident of our cities and towns or of our rural districts.

'And whereas, the provincial health authorities have jurisdiction only over those waterways lying within the interprovincial boundaries and are unable to protect those resident therein against pollution which may happen either in a contiguous province or in an adjoining country;

'And whereas, in some instances these pollutions are great and widespread by reason of the immensity of our international waterways upon which there are annually carried some ten millions of people;

'Now, therefore, this Conference of the Dominion and Provincial Health Officers recommends:

'1. That the Government of the Dominion of Canada enact a law prohibiting and penalizing the deposition of raw sewage, garbage and factory wastes in the waterways of Canada and in waters tributary thereto, along the lines of the draft Bill herewith appended, such Act to be administered by the Dominion Minister of Agriculture.

'2. That the provinces be requested to give effect to such legislation so that there shall be no conflict of jurisdiction between the Dominion and Provincial Governments in regard to these matters.

'3. That the several legislatures of the Dominion of Canada be recommended to insert in their Public Health Acts the following clause:

'No by-law providing for the raising of money for the construction, operation or extension of any system of waterworks or common sewer or system of sewerage or sewage disposal, shall be submitted to the votes of the electors by the council of any municipality until the consent of the Commissioner of Public Health or of the Provincial Board of Health, as the case may be, to the proposed construction, operation or extension, has been first obtained, and the preamble to every such by-law shall declare that such consent has been duly obtained; no debenture shall be valid if issued under any by-law passed in contravention of the provisions of this section.'

'This clause, we believe will have the effect of preventing municipalities from evading the present provisions of the Public Health Act in this respect.'

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I may say that it was a common experience in Ontario that, notwithstanding the comparatively stringent Health Act, municipalities would install sewerage systems and often pollute their own water supply, although the plans had been condemned by the provincial health authorities; and it was with the object of getting over this difficulty, that we recommended putting what is known in England as the veto power of the Local Government Board of Great Britain into this legislation. This is the effectual way of getting at municipalities and of preventing them from raising money to do something that will be unsanitary when completed.

‘And that it be urged upon provincial authorities to adopt legislation providing for the systematic supervision and inspection of all water purification and sewage disposal plants so that the same be maintained in their efficiency; and

‘4. That we strongly urge upon the Commission of Conservation to request the government of the Dominion of Canada to consider the necessity of conferring with the Government of the United States, with a view to preventing any further pollution of international waters.’

Then follows the Bill which Mr. White submitted at the last meeting.

It may here be noted that the provincial authorities were unanimous in their recommendation that action should be taken by the Dominion Government, and legislation passed by the House of Commons along the lines indicated in the proposed Bill. Further, that Senator Belcourt introduced the Bill to the Senate and it passed, a ‘Bill respecting the Pollution of Navigable Waters,’ April 4, 1911, and the Bill as now before your committee has again passed the Senate.

In a pamphlet the question of the pollution of waterways and that of pure water was presented to the Conference. It contains the legislation, as then in force, in the several provinces of the Dominion, as to pollution of waters therein as well as legislation then in force in foreign countries as well as in many of the states of the United States, all of which may be of interest to the committee.

The practice in Canada has been to deposit sewage in a raw, untreated condition into any body of water irrespective of whether as a result public water supplies are contaminated or a nuisance is created. When the dilution is great, or by reason of sparse settlement of the country contiguous to the body of water into which the sewage is discharged the conditions have not become a nuisance, the various provincial authorities have in many instances permitted the continuance of the practice.

The province of Saskatchewan, however, was wise enough to anticipate the insanitary practice and upon the establishment of a Department of Health passed legislation making it impossible for the practice then common in the older provinces of the Dominion to be repeated by urban municipalities therein. That was also referred to at your last meeting.

With the rapid increase of our urban population and the growth of our industries, it has been made evident to health authorities that the time has arrived that more sanitary and scientific methods must be adopted. The reason for this is apparent when towns and cities take their public water supplies either from running streams, rivers or lakes. And it is to these that our municipal authorities have turned for that essential of life.

In Canada, very few cities draw their water supply from what are known as upland areas—areas in which no sewage is deposited, and where the municipalities can protect the gathering grounds from sewage being deposited there, the same as that now proposed by the city of Ottawa, in which there will be no possibility of sewage contamination. There are some few examples in Canada where cities have been able to derive their water supply from upland sources. In Ontario, Fort William derives its water supply from a lake on top of Mount Mackay, and that city has acquired the right to protect the whole of the gathering grounds.

The results of the pollution of our lakes and rivers have been clearly indicated



in the report of the Commission of Conservation, and it is a fact that in many instances typhoid fever in most of our cities and towns is due to this careless and criminal method of polluting our lakes and rivers by human excreta in an untreated state. I quite agree with Dr. Connel that it is not so much polluting the water supply of other municipalities, but that it is polluting their own water supply.

That the time has passed for a continuance of this reprehensible practice is quite apparent from the legislative action of many of the provinces. That action by the Federal Government is necessary in order to make the work effective and uniform is evidenced by the unanimous findings of the Conference, as reported by the Commission of Conservation.

The jurisdiction of the Federal Government extends to all navigable waters, and, as raw sewage deposited in waters tributary thereto must silt up and pollute navigable rivers and lakes, it is evident that the Government having control of them must take some steps to protect the same.

In the case of the harbour of Toronto. I suppose it has cost a very large sum of money to dredge it out and keep it a navigable body of water, by reason of the great amounts of silt and sewage sludge which have been deposited by the city of Toronto into that harbour. It is an annual cost not only upon the country at large but upon the city itself.

In the case of interprovincial waters the necessity for Federal legislation is emphasized as particularly when the laws of the interested provinces are either not identical or where the standard of control is not similar. Here, for obvious reasons, it is essential in the interest of health and when the waters are navigable that some Federal standard and jurisdiction must be maintained.

For example, take the Ottawa river, one side of which is in the Province of Quebec and the other in the Province of Ontario. At the present time, I am quite free to confess that Ontario is the greatest offender, because we have a larger population and more towns on this side of the river. But with the growth of this country, and the growth of the Province of Quebec, the difficulties will increase. At present there is no uniform law and no power to require uniform action in Ontario and Quebec, so that there will be a common basis by which the municipalities will all be dealt with alike. You might deal with Pembroke, Ontario, in one way, but the next town on the Quebec side might be dealt with altogether in a different way by reason of different law in Quebec.

In all of these respects the case is urgent, in many instances right now, but with the great increase of our country and in order to prevent disease and death, instances are being multiplied and present day conditions intensified which should be provided against by the federal government, which will co-operate with and co-ordinate the work from the Atlantic to the Pacific.

There exists a greater similarity between the sewerage systems of Canadian and British towns and cities than that prevailing in the United States. The British system of combined sewerage systems prevails here, that is one in which the sewers carry off both domestic sewage and storm water. We have large sewers in which we provide for the storm water as well as the domestic sewage. In many places in the United States they have what they call the separate system—they simply carry off the water from the houses and the domestic sewage, and provide otherwise for the storm water. This very fact makes us follow more closely the British method of disposal, for few American municipalities with combined systems have constructed works for sewage treatment.

The history of the problem of sewage treatment in England dates back to 1845, when the first Public Health Act was passed. Since then, owing to the density of population, the development of industrial activities and the fact that the rivers are but of small size and land of suitable character is scarce, the municipal authorities

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have spent large sums of money in the construction of works or plants often to find that they were ineffective.

I may say, Mr. Chairman, that Great Britain has carried on an immense amount of experimental work at a tremendous cost to the municipalities in regard to sewage disposal, perhaps more so than any other country in the world. In France and in Germany they have been able to dispose of sewage in many towns and cities on sewage farms. England started out on that scheme. Birmingham, for instance, had 4,000 acres of land, pretty valuable land too, but they found they were not able to carry on a sewage farm, and so dispose of the sewage of that great midland city.

These costly experiments have resulted in an evolution of sewerage systems, each a little better than the last, and at the present time the methods in use in that country may be classified generally as:—

- (a) By contact beds.
- (b) By percolating filters.
- (c) By chemical precipitation works.
- (d) By sewage farms.
- (e) By deposition into tidal waters.

Of course, there are many variations in the details of construction and operation consequent on the particular patent or unpatented process in operation. They all, however, have a common aim, that is, to produce an effluent which will not create a nuisance and will be acceptable as working plants to the central authority.

While in Great Britain the Local Government Board have this veto power in regard to systems, yet the question of the pollution of rivers is administered altogether under another Act, as outlined by Mr. White, the Rivers Pollution Act. But the control is virtually held by the Local Government Board of Great Britain through this veto power, and the two co-operating have been able to gradually raise the standard of the effluents as deposited in the rivers, and so have materially improved the conditions in Great Britain. But the Local Government Board really forced upon municipalities the disposal of sewage upon land. It was the land treatment for many years. They followed out that scheme, and enforced it upon municipalities; and it is only within a comparatively few years that the Local Government Board have relaxed in regard to land treatment. They have become a little more elastic and have permitted municipalities to adopt certain of the schemes or combination of the schemes mentioned. For instance, take Birmingham, in a comparatively few acres, 60 or more, they treat the bulk of the sewage of the city and turn out a better effluent than when the city used 4,000 acres for sewage farms. They are still using some of that land for a sewage farm, but Birmingham is gradually extending their system, and it is on the most approved methods; and all this by reason of the Local Government Board accepting more scientific principles as they have gradually been evolved.

*By Mr. Kyte:*

Q. Will you please explain the method employed on these farms for the disposal of sewage?—A. If I am not detaining you too long, I will cite a personal experience. Twenty-five years ago I was at Birmingham. At that time they had a little over 2,000 acres of what they called a sewage farm. The sewage came down to the farm.

Q. How was it conveyed?—A. It was brought in a trunk sewer to the works, screened, and then was passed into tanks where the grosser material sedimented. Then the sewage was run off into different portions of the land where it settled, then ploughed up and sown, some sections with grass, other sections with root crops. Then sections were irrigated by the sewage and as many as five or six crops of grass taken during the season. There was also a stock farm in connection with the works.

Q. Run by the city?—A. Yes, and they would raise stock and have annual sales. They would feed the fodder to the cattle. That was the method pursued by the city

at that time, and that is the general method followed on sewage farms. I may say, Mr. Chairman, that this method was tried in one place that I know of in Canada, Berlin, Ontario. Berlin was a manufacturing town, now a city and they had suitable sandy land. The farm itself, as well as the effluent, proved such a nuisance that actions were brought against the town, actions for damages from the farmers living on the stream into which the effluent was discharged, and the town had to pay those damages. The municipality of Berlin appealed to the Ontario Board of Health and some years ago the plan was worked out for the present system which is in successful operation.

Q. They abandoned the farm?—A. They had to, it is perfectly impossible here in the winter time to carry on a sewage farm; what was to be done during five or six months of the year? The sewage could only be diverted into the creek and the result was the farmers had to fence off the stream, they could not use it for their cattle. That is one example, Mr. Chairman, of an experiment here in Canada, which cost the town a considerable amount of money and demonstrated to the health authorities in Canada that it was impossible to carry on a sewage farm even where they had suitable land, similar to that which is used for the purpose in many parts of France and Germany.

*By Mr. Kyte:*

Q. They are not carrying on that system in any part of Canada now, are they?—A. Not that I know of.

Q. I thought they established one in Montreal some time ago?—A. My understanding is that some municipalities on the recommendation of their engineers have established experimental farms, just a few acres, to see what the possibilities were, but Berlin introduced this method of treatment of the sewage for the whole town.

*By Mr. Edwards:*

Q. I understand that at the London asylum they carry on such a system as that?—A. Mr. Chairman, that is an institution where there is a certain class of inmates who are able to work out on the farm, and aid in the disposal of the sewage on the land, but you could not do it in a town; that is an institutional plant, and that particular one has been a success, yet, Mr. Chairman, there are difficulties there in regard to disposal of the sewage of 1,200 or 1,500 people.

Q. And there is a similar system at the Maryland Asylum in the United States?—A. Yes, but you cannot compare our Canadian conditions with those that exist further south where they have not the severe winters that we have in Canada.

*By Mr. Warnock:*

Q. You mean it might be done on a small scale in Canada, but it could not be done here generally?—A. Yes, but you cannot do it in the winter time. There might be some localities where you could treat sewage in that manner but the climatic conditions exclude the question of farms in this country.

Q. There are a number of sewage farms in operation in Great Britain?—A. Yes, a few now, but many municipalities are also carrying on experimental works in addition to the present plants. Even in the great City of London they are now carrying on experiments for the purpose of determining how much better an effluent they can run off into the river Thames. Reports of these experimental plants are made from time to time, and they are judging from the results of the treatment of limited amounts of sewage how far the treatment can be applied to the whole scheme.

‘This central authority is the local government board, which through its veto power over permanent municipal loans, not authorized by Parliament, controls to a very large extent the character of all sewage disposal works. This Board

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for years insisted on the final application of sewage to the land, quite regardless of the previous methods employed to treat the sewage. Recently, however, this requirement has been modified in certain instances, a result no doubt of the Royal Commission on Sewage Disposal which has been in existence for some years.

That this Department is along most approved lines, the following expression of opinion of Dr. Calmette, the Director of Sewage Investigation in France, is of interest. He says, 'that great land operations for the disposal of sewage can only be carried out by the principal capitals or by the smaller communities when there are great tracts of land with sandy or chalky soil, very absorbent and of little value, and that, in the case of towns of less importance and less favourably situated, it is absolutely impossible to have recourse to this method at all.'

The control exercised by the Local Government Board has been conservative in character and possibly its influence has prevented the municipal authority from engaging in work which in the end might have proved costly experiments—while on the other hand the duties of the Commission have been to study difficulties and find out how they can be most economically and efficiently solved in the interests of the health of the people generally. The results in England have, on the whole, been satisfactory, although not altogether pleasing to certain ones who are interested in one or the other of the diverse methods of sewage treatment. The experience in Great Britain is that there should be legislation to prevent the pollution of waterways, controlled by the Department of the Government, with power to enforce the regulations made under Act of Parliament. But it is fully realized by sanitarians, municipal authorities and officers of the Local Government Board that no hard and fast rules should be promulgated for dealing with sewage, but in any case, local circumstances must be considered, after investigation by expert officers of the Department.

*By the Chairman:*

Q. Now, Doctor, in addition to that, have you collected the laws of the several provinces in respect to the disposal of sewage?—A. That has been presented to you by Mr. White to-day. To show how some of the provinces have viewed this important question, and they are aware that pollution has reached such an extent that it ought to be stopped—as stated at a previous hearing, Saskatchewan was the first to introduce veto legislation. In the Province of Ontario the Act of last session, 1912; is even stronger than that of Saskatchewan; perhaps being more densely populated, and having a larger number of manufactories it has been more up against this proposition of pollution than any other. Section 95 of the Act says:

'(1) No by-law shall be passed for raising money for any of the purposes mentioned in sections 89 and 94 until the proposed water supply or sewerage system, as the case may be, has been approved by the Provincial Board of Health, and such approval has been certified under the hand of the chairman and secretary of the Board.'

Then it goes on to say:

'(2) The by-law shall recite the approval of the Board.'

Then section 96 provides:

'(2) The by-law shall not be finally passed until the approval of the Board has been obtained to the work to be done as herein provided, and shall recite such approval.'

Municipalities cannot really raise the money for sewers or sewage disposal without the approval of the Provincial Board, and in Manitoba, although they have not yet adopted the veto power, I think they have stringent laws very much along the lines existing in Ontario.



*By the Chairman:*

Q. You say they have very strong laws, but are they enforced in any of the provinces?—A. That is just the very point. Our Health Acts in Canada are very nice things to look at, and the pictures of the Acts in the United States are also very nice, perhaps they are more beautiful than ours, but the whole trouble is you can go to any town in the country and you will find they are not properly enforced. That was the difficulty in the province of Ontario, the Health Act of Ontario was a very nice Act, but it was left to the municipalities to enforce, there was no power given to any central body to say to the municipality, 'You shall do this in the public interest.' The municipalities did what they pleased, the Act said they may do this and they may do that—but now in Ontario it is quite different, the Provincial Board has power which is being exercised. In many provinces it is still a case of what they may do, but there is no central power to take hold and say, 'You must do this.'

Q. Is not that the main reason for the enactment of a federal law, that is to have sewage disposal properly enforced?—A. Yes, Sir, it is, and might I go a little further—while the provinces of Canada to-day are dealing with matters of public health, yet it is a peculiar fact that public health for the first four years after Confederation was dealt with by the Federal Government, and it appears to me there is nothing in the British North America Act to-day which relegates public health to the provinces. It is simply a concession to the provinces, and those who, like myself, have been engaged in public health work for many years have felt that there must be some central authority governing this matter, because health is not municipal, it is not provincial, it is national, and must be dealt with by a national department of health. By that I mean a department not composed entirely of medical men, trained in public health, but you want sanitary engineers, chemists, bacteriologists and others, you want experts in all the various branches of health work, and only the Federal Government can stand the expense of engaging those experts. Instead of going to the United States for experts, we should have them here, right at home; we are large enough, we are rich enough, and the time is ripe for it.

Q. Have you any suggestions to make along this very important line as to how we should train or produce sanitary engineers in this country?—A. Yes, Sir. May I give an illustration. In the province of Ontario for the last eight years, they have been taking one or two engineers graduating from the School of Practical Science who usually devote their attention to sanitary engineering, apart from the other branches of engineering, and these young men are engaged in the experimental plant of the Ontario Board of Health, that is the experimental plant where the experiments are carried on regarding water purification and sewage disposal, and many other things relating to sanitary engineering. They have received \$500 or \$600 a year, but after they have finished their year of post-graduate work there has been no other position for them. The government did not want them, and municipal authorities are not yet alive to their importance. The government, however, has taken the step this last session and made it possible to employ a sanitary engineer for the province, and the salary has been fixed at a minimum of \$1,800 per annum, hitherto there has been no possibility of development, even along local health lines, for these young men. Why? Because anybody that would be appointed by a municipal council or by the government—a man that would devote his time and attention to the work—would not have his position guaranteed. But once you establish a federal department of health, it would be different. Take for example, the Federal Department of Health of the United States. They have a good service. A man enters that service at a minimum salary. His position corresponds to that of a lieutenant in the military service: The latter serves his time and works up from rank to rank. He gets promoted to captain, then to major, and then to colonel. With each step in rank his salary is advanced, he renders himself more efficient, and is detailed to duty here, there and

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everywhere. As it is in the case of the United States Department of Public Health, so it would be in a Canadian federal service, only it should go further than that of the United States.

*By Mr. Warnock:*

Q. You have a very striking illustration of your argument in the federal control of contagious diseases of animals in Canada.—A. I am very glad you have mentioned that; it is an illustration I did not care to bring forward. There you have an illustration of the Federal Government assuming all the prerogatives of the Provincial Governments which are delegated to them by the British North America Act. There you find an example where the provinces have ceded to the federal authorities—it is too long a question to go into—for the benefit of Canada as a whole the control of contagious diseases in animals.

Q. That was purely voluntary on the part of the provinces?—A. Yes, purely voluntary. But there was a *quid pro quo* in the shape of financial aid given by the Federal Government in return. One of the provinces held out for some time against the arrangement, but, realizing that if it continued its opposition it would not receive any financial aid, like the other provinces, it ultimately yielded. Now the supervision of the contagious diseases of animals is magnificently carried out by a department in which you have your federal veterinary officers and your federal bacteriologist and you have federal laboratories. My advice to you is that if you want to deal satisfactorily with this question of the pollution of water supply you should establish your Federal Department of Health just as you have established a department in the case of the contagious diseases of animals, and do it on the ground that it is for the general welfare of Canada. I do not say that you should over-ride the provinces. On the contrary you should act in co-operation with them because there is no officer of any Provincial Government but would work in hearty accord with federal officers if the Dominion authorities organized a department such as suggested.

*By the Chairman:*

Q. Just another question. Do I understand you to say that the Federal Government have the right, under the British North America Act to do as you suggest?—A. I am not speaking as a lawyer. My opinion is based upon the fact—formed from reading judgments of the Privy Council—that unless the jurisdiction of a matter is specifically vested by the British North America Act in the provinces, that jurisdiction is exercised by the federal authority. Now, the matter of public health is not mentioned in the British North America Act, and I gather by deduction that therefore the control over it is one of the functions of the Federal Government. In 1867, when the British North America Act went into force, very little was known on the subject of public health or sanitary science; it has been a matter of evolution since. It was only about that time that Great Britain was actively thinking about the subject of public health. For four years after Confederation the Federal Government of Canada did exercise jurisdiction over the work here.

*By Mr. Baker:*

Q. Why did it abandon that jurisdiction?—A. That is a matter of history. I cannot remember the precise reason just now, but it is to be found in the records of the House of Commons.

Q. You would not consider that the control of the public health was part of the powers of the provinces under their rights of autonomy?—A. The Act specifically states eleemosynary institutions, and you can hardly classify public health as an eleemosynary institution.

Mr. NORTHRUP.—The Confederation Act was based upon the experience of our American cousins. In the United States the residue of power had been vested in the

several States, whilst the Federal authority exercised only control that was assigned to it. In this country, in order to avoid trouble, the residue of power was vested in the Federal Government, the Provinces only having the right to do certain specific things.

The WITNESS.—Might I be permitted to say that the conditions were different as between the unifying of the States of the Union and the unifying of the Provinces of Canada. At the time of Confederation those Provinces were Crown Colonies.

*By Mr. Northrup:*

Q. The arrangement was purposely made at the time of Confederation, in order to avoid the trouble which had occurred in the United States, that the Federal Government should have the residue of power?—A. Quarantine is a national power, and the control of it is exercised by the Federal Government. For four years it also exercised control over matters of public health. Then difficulty arose between the Federal Government and the Provinces over questions of patronage and pay.

*By the Chairman:*

Q. Have you any tables to put in showing the mortality from typhoid in Canada?—A. Yes, I desire to file certain statements showing the mortality in the year 1911, together with the death rate per 100,000 for the census year 1911. The tables are not complete owing to the fact that I have not the returns of the Census Department. (See Exhibit No. 6 in the Appendix.) They are figures for the various Provinces, but I cannot give you the cases.

Q. Is there any way of giving the cases?—You say there were 20 deaths in the first typhoid epidemic in the City of Ottawa. Can you get for us the number of cases?—A. No, sir. Take the last two outbreaks of typhoid fever in the city of Ottawa. We made a careful canvass at the time and found cases that had not been reported. Now, if you have not complete reports of cases during epidemics, particularly when they are of an alarming character, it stands to reason the cases will not be as well reported when they are only of an isolated character.

Mr. NORTHRUP.—I understand that a pamphlet has been prepared by Mr. T. Aird Murray, giving the death rate from typhoid in European countries.

The WITNESS.—I might refer you to the tables I have handed in. They will give you in graphic form the annual death rate per hundred thousand of the population. The figures are:—

Scotland . . . . .	6.2
Germany . . . . .	7.6
England and Wales . . . . .	11.2
Belgium . . . . .	16.8
Austria . . . . .	19.9
Hungary . . . . .	28.3
Italy . . . . .	35.2
Canada . . . . .	35.5
United States . . . . .	46

*By Mr. Baker:*

Q. What period of time does that cover?—A. In nearly every case from 1901 to 1904. In some cases it includes 1905.

*By the Chairman:*

Q. The United States and Canada exhibit the highest death rate of all countries?—A. Yes. The Italian emigrant who comes to Canada runs a greater risk of developing typhoid than he does in his own country.

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*By Mr. Baker:*

Q. Is that by reason of the want of better facilities for purifying the water?—

A. Yes. In Italy most of the water comes from the mountains. There, although they have unsanitary housing conditions in many places, they have not a sewage polluted water supply, and there is less danger of typhoid fever infection from that cause.

One of the charts handed in gives the death rate from typhoid in certain American cities, viz.: Ashtabula, Buffalo, Chicago, Cleveland, Detroit, Milwaukee, Niagara Falls, Ogdensburg, Port Huron, Sault Ste. Marie and Toledo.

Another chart refers to Canadian cities, viz.: Edmonton, Nanaimo, New Westminster, Rossland, Vancouver, and Victoria, B.C.; Winnipeg, Man.; Moncton and St. John, N.B.; Halifax and Sidney, N.S.; Fort William Hamilton, Kingston, London, Niagara Falls, Ottawa, Peterborough, St. Catharines, Stratford, Toronto, Woodstock, Ont.; Charlottetown, P.E.I.; Montreal, Quebec, Sherbrooke, Que.; Saskatoon, Sask. This statement is for the years from 1900 to 1909.

*By Mr. Edwards:*

Q. What was the cause of the Fort William outbreak?—A. There they took their water supply from the Kaministiquia river. A vessel dragged its anchor and broke the intake pipe, but the city instead of repairing the pipe went to law with the company that was responsible for the accident. In the meantime typhoid fever broke out and in that place with a population of less than 10,000—I think it was only 8,000 or 10,000 about that time—one in every four of the population virtually had typhoid fever. Professor Starkey of McGill went up there at the instance of the municipality, and his report was published by the Ontario Board of Health. Over 100 deaths resulted from that epidemic.

Witness retired.

Committee adjourned.

FRIDAY, May 16, 1913.

The Committee met at 10.30 a.m., the Chairman, Mr. Bradbury, presiding.

Mr. R. S. LEA, sworn.

*By the Chairman:*

Q. You are an engineer residing in the city of Montreal?—A. Yes.

Q. Are you employed on the engineering staff of the municipality of the city of Montreal?—A. No, I am engaged in private practice as a consulting engineer in the city of Montreal.

Q. The Bills, I suppose, that are before this Committee have been brought to your attention?—A. They have, yes.

Q. I suppose you have formed some idea on the Bills?—A. Yes, in a general way. I only knew that I was expected to give evidence here the night before last, so have not prepared anything in the way of a statement, but I shall be very glad to answer any questions or make any explanation suggested by the Committee.

Q. You have taken considerable interest in the question of the pollution of streams from a professional point of view?—A. Yes, I have been engaged since 1890 in the practice of the profession of engineering and was for several years in charge of the department of municipal engineering of McGill which includes sewerage, sewage disposal and water supply.



Q. Do you consider that the streams and the lakes of Canada are polluted at the present time?—A. Of course all streams flowing through populated districts are bound to be more or less polluted. But in the case of Canada the large rivers, at least, like the Ottawa and St. John, are not at present polluted to a very great extent.

Q. And the St. Lawrence?—A. It is not very much polluted at the present time. In speaking of that pollution, of course it depends upon what phase of the subject one has to consider, that is to say, if we refer to pollution, such as would cause a nuisance by the decomposing of organic matter, then the pollution in the river is slight. Speaking of pollution, from the standpoint of water supply, that is where the water is to be used for drinking, the pollution is in some cases greater.

Q. Do you consider the present system of disposal of sewage in Montreal is the proper system, in view of the presence of a large population on the banks of the river below that city?—A. Well, as a matter of fact, there is no treatment of the sewage of Montreal prior to its discharge into the river. It might be discharged in a better way, that is it might be discharged into the deep channels so as to mix with the water more quickly than it does. So far as the health of the people is concerned, and I presume that the real object of this Bill is to protect the public health, I think that along the lower end of Montreal island, at least, the people who use the water for drinking would be very much benefited by filtering. As a matter of fact they should filter it in any case. If they do so the water is not a menace and the danger to health would not be very great after the sewage has been mixed with a large volume of water. For example the Board of Health of the province of Quebec made a sanitary survey of the Ottawa river, which has of course a very much smaller flow than the St. Lawrence. The latter river has twelve or fifteen times greater discharge than the Ottawa, yet the effect of the discharge of sewage into the Ottawa could scarcely be detected in the Lake of Two Mountains. In fact, the river is scarcely contaminated down there at all. The water is very nearly in the same condition that it is above Ottawa. The maximum bacterial pollution found was about 1,800 bacteria per cubic centimetre not far below the outlet at Ottawa, near the influence of the sewers, but it gradually decreased to less than 100. On the other hand in the case of the water of the Susquehanna river, which supplies the city of Harrisburg, which has one of the best filtration plants on the continent, there are often 16,000 bacteria per cubic centimetre or more

Q. That is before the water was purified?—A. Before it was purified. Last year after it was treated its average was only two or three.

Q. How is that water treated?—A. First by sedimentation, with the use of a coagulant, then filtered by mechanical filters and then treated with very small quantities of hypochlorite.

Q. What amount of bacteria in water would you consider dangerous to the consumer?—A. The bacteria derived from sewage all more or less indicate danger; sewage may contain bacteria of infectious diseases like typhoid.

Q. Have you any theory as to the distance from the source of pollution that it would be safe to use water for drinking purposes? For example, how far below the city of Ottawa do you think the water would be polluted to a dangerous extent by sewage?—A. The survey to which I have already referred showed that when the water of the Ottawa river gets into the Lake of Two Mountains it is there afforded a chance to settle and practically all the pollution that has taken place is removed. It is not so very much a matter of distance as of time, depending upon the sluggishness or swiftness of the flow. My idea, however, is that it is not safe to drink surface water which contains sewage in any case without filtering it.

Q. Do you, as an engineer, think it is necessary that the present system followed by great cities and municipalities of emptying their sewage into rivers should be stopped?—A. Yes, in many cases, but what I really think is this: associated with the necessity of purifying the sewage should be the necessity of filtering the water in every case, because the object is to protect the health of the people drinking that water, and you get certainly less protection from purifying the sewage. If you purify

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the sewage you only remove a certain amount of the proportion of the pollution that gets into the river. Besides, about two-thirds, I imagine, or more, of the larger cities in this country have a combined system of sewerage, and so a sewage disposal plant would really only work effectively during dry weather. On rainy days, especially during heavy rains, the overflow which the sewage disposal plant, for economical reasons, could not possibly deal with, would flow untreated into the river and carry a large proportion of the sewage with it. For that reason alone I should not say that the treatment of sewage protects you completely or anything like it, although it certainly would protect to a very considerable extent.

Q. Do I gather from what you say that your experience would lead you to the conclusion that the sewage should be treated before it enters the water by the cities and municipalities?—A. It is hard to make a general statement like that. In some cases, yes, and in other cases it would, I think, not be necessary. In fact, the great majority of places in the world do not treat their sewage in any way, although many of them should. In other cases they do not consider it necessary, depending upon the use which is made of the water afterwards.

Q. Of course you realize that in Canada two-thirds of our towns and cities located on rivers draw their water from those rivers?—A. Yes, and for that reason I think that combined with the necessity for sewage purification—which should be taken up before the water really gets seriously polluted—should certainly at the very start be associated the necessity for the purification of the water. For instance, the typhoid fever rate in the Old Country and Europe, which is much lower than in the United States and Canada is really due to the purity of the drinking water. The sewage in England is not purified to any extent from a bacterial point of view, but the water supplies are filtered or taken from protected sources.

*By the Chairman:*

Q. To what extent would you say sewage should be treated before it is put into the water?—A. Of course, that is something which should be decided for each municipality, but I recognize that it is impossible to legislate on any such basis as that. There must be some general method applicable to the whole country. One method will not suit in every case. A special case would have to be treated in a different way. Again, there is the great difference in conditions between the Middle West and the rest of this country. There we have an entire difference of climate. Part of that country is properly designated as semi-arid, and for a long period in the year there is practically no water in the country at all, except in the rivers and larger creeks. But that is not the case down here where we do not depend entirely on streams. We have wells and other sources of supply, but out in the West the only way people can get water when their wells run dry is by getting it from the river. Consequently, I think more stringent regulations should be made for that part of the country. But the question you ask, I have so far not directly answered.

Q. To what extent should sewage be treated before it goes into the water?—A. I think as a general rule, the suspended matter should be taken out. That involves really one of the most practically difficult matters in sewage disposal. I mean, dealing with the sludge.

Q. Would you treat the fluids at all?—A. In many cases, yes, possibly in the majority of cases.

Q. Are you acquainted at all with Western rivers?—A. Yes.

Q. What theory would you propound in regard to the rivers of the West. You know the nature of those rivers?—A. The first thing I should do is to have a water filtration plant for every town that takes its water out of the river. Then the sewage should be treated.

Q. Which should come first?—A. Water filtration, because it is so much more effective. It may be considered as the first line of defence. Sewage purification is

the second. The high typhoid fever rate would be lowered at once by the purification of the water supply of the people in the cities, whereas it seems to me that the benefit from purification of sewage up above would not be felt to its fullest extent until all the towns had purified their sewage.

Q. The object is to get pure water. Would it not be better to remove as much as possible the danger from the effluent that goes into the river. Would it not make it easier to get purer water?—A. I do not think it would make much difference on the Ottawa river, for instance, but in a smaller river it certainly would be safer. Filters, like everything else, may get out of order, and in that case the purer the water the safer it would be, even with the filters. It costs a lot of money to filter sewage and a good deal of money to filter water, and of the two it is much cheaper to filter the water, and it seems to me the most effective—that is from the point of view of protecting the public health. If the sewage is fouling the river bed and making a nuisance, that is another matter altogether.

Q. I need not remind you of the heavy death rate from typhoid fever in Canada. In view of that, would you, from your own experience as an engineer, say that you could guarantee pure water by filtration alone, under our present system?—A. I would guarantee to lower those death rates by one-half or two-thirds or more. As to absolutely guaranteeing pure water at all times by filtration, that could hardly be done in any case as long as there was sewage bacteria in the river.

Q. If the effluent put into the river was treated, would you not be better able to guarantee pure water by filtration? Would it not aid in getting pure water?—A. It would, in case the filters went wrong.

Q. What I am trying to say is this: that if the sludge was all taken out and the effluent itself was purified before it went into the water, would not that be a great aid to any filtration plant in guaranteeing pure water?—A. Some aid, but not very much. The filters are very effective as they are. The example I gave you, of the Harrisburg filter, shows that although the bacteria numbered many thousand per cubic centimetre, the effluent was practically sterile.

*By Mr. Carroll:*

Q. The same holds good of cities in the west, such places as Saskatoon, for example?—A. Yes. I do not know whether they use hypochlorite or not.

*By the Chairman:*

Q. What is your idea of purifying the tributary rivers that flow into a big river?—A. If sewage is discharged into them and they are used for water supplies I think the necessity is greater than in the case of the large river.

*By Mr. Murphy:*

Q. You mentioned some point below the city of Montreal, where, in your judgment, the water should be treated before being used for drinking purposes, did you not?—A. Yes.

Q. What distance was that below the city?—A. Fifteen to twenty miles. The reason I say that particularly is because the sewage of Montreal for some distance below the outlets clings to the shore. Longue Pointe, for instance, a short distance below Montreal, takes its water from the river there, and the number of bacteria has been found to be as high as sixty or seventy thousand per cubic centimetre. It is being treated by a mechanical process now and by hypochlorite, and is satisfactory. I was going to say that while that is true, I do not think it is fair to put all that load on the filter, and if there were many places that had to take water as badly polluted as that, I should say that Montreal should purify its sewage. Of course, it could not for a moment undertake to do it for just one place like that.

Q. You also mentioned that at the present time the sewage in Montreal is not treated in any way. Are they not preparing to do that?—A. Yes. I mentioned that.



Q. What sort of treatment are they going to put in operation there?—A. That has not been decided yet. It is under consideration.

Q. It is proposed to put it somewhere between Cartierville and Bordeaux.—A. That is for a portion of it. It may not be the ultimate decision to dispose of it there.

Q. The process has not been actually decided upon?—A. No.

*By Mr. Northrup:*

Q. Do I understand the sewage in Montreal is poured right into the River St. Lawrence?—A. Yes.

*By Mr. Chabot:*

Q. The method in Montreal is followed by all the towns and cities in Ontario. I do not suppose there is a single town which has not had typhoid at some time or other, and in no instance has it been shown that any of these towns have taken the least precaution in regard to the disposal of their sewage into the navigable rivers or lakes. The result is that in Canada to-day the typhoid rate is between thirty and forty per hundred thousand, whereas in England it is only five or six per hundred thousand. You are aware that in England and Europe the towns have incurred vast expenditure to install plants for the disposal of sewage. Why should not the same thing be done in Canada? Do you not think that would be the only way to prevent typhoid—by protecting the water supply?—A. No. The death rate in Europe, as you have stated, is low, and sometimes about five or six per hundred thousand, and the rate is high in Canada, but I do not think Canada's high rate is because the towns have not treated their sewage, but because they do not filter their water. I am personally confident of that. The English rivers are much more impure than our rivers, speaking generally, and they do not depend, in England, upon sewage purification to protect their water supplies. The rivers are small and the population is large, and in England the water supply is rarely taken from polluted rivers, and never from sewage polluted rivers without being filtered. The same applies to Germany. No surface water in Germany may be supplied to a town without being filtered, and it is to that fact the low typhoid fever rate is due. The cities of Altona and Hamburg had a high typhoid death rate, but as soon as a filtration plant was installed the death rate fell. The same thing happened in the case of a city in Massachusetts, which had an abnormally high death rate from typhoid until a filtration plant was put in. Then it fell to a very great extent. The English rivers are much more polluted, even after the sewage has been treated than are our rivers here from every point of view, but particularly from the hygienic point of view.

Q. You do not think that purification beds for carrying the oxidisation methods into effect would lessen the danger of pollution in water.—A. Yes, I do.

Q. That is being done on the other side, especially in England.—A. They make no attempt to get their rivers bacterially pure. Speaking generally, none of our rivers in Canada are in immediate danger of being so polluted, very far from it. As I said, it is pretty hard to detect pollution at all, by chemical methods a few miles below Ottawa.

The CHAIRMAN.—A case in point occurred this winter. Hawkesbury is sixty or seventy miles down the river. There was a serious outbreak of fever there this year and it was decided by Dr. McCullough that the outbreak was due to the pollution of the Ottawa River.

The WITNESS.—I do not believe that any surface water into which sewage is discharged is safe to drink without filtration; but I was referring to the pollution caused by organic matter in the river. As a matter of fact, the dilution in the Ottawa is almost a thousand to one of sewage. In many places in America a dilution of from thirty to one hundred to one is considered sufficient.



*By the Chairman:*

Q. That is as far as nuisance is concerned?—A. Yes, only so far as nuisance is concerned.

*By Mr. Chabot:*

Q. We have had two or three epidemics in the last five years in Ottawa. The water in the Ottawa River, under normal conditions, has always been considered pure and healthy. I am a medical man and am speaking as such. I believe that the cause of the typhoid epidemic in 1910 and 1911 was due to contaminated water, which occurred above the Chaudière Falls?

*By Mr. Carroll:*

Q. If you filtered the sewage, you would get pure water. Is not that so?—A. But the pollution of the Ottawa water came from half a mile or so from the intake.

Mr. MURPHY.—That is not correct.

The WITNESS.—Within four or five miles anyway.

Mr. MURPHY.—No. It was below the intake. The intake is in what is called Nepean Bay.

The WITNESS.—I know Nepean Bay very well, near the inner end of the intake-pipe. It holds the sewage and is there really a polluted body of water. That is certainly a case where I would not trust to filtration alone, that is, in cases where the outlet of the sewer is in close proximity to the intake. That is imposing too much upon filtration. I think that in any legislation to be passed there should be included the power to compel the filtration of drinking water from such a source, even with sewage treatment. In the case of the Middle West, as I said before, I should go much further than elsewhere, because not only do towns take their water supply from the rivers, but individual families are compelled to do so too, and much more so than at other places where the rainfall is normal, and for that reason I should be inclined to go as far as finances would permit.

*By the Chairman:*

Q. Are you familiar with the Red river?—A. Yes, I had something to do with that in connection with Winnipeg's water supply.

Q. You know what the conditions are at Winnipeg at the present time. A large dam has been built twelve miles below the city, and the cities of Winnipeg, Brandon, Portage la Prairie and St. Boniface—I suppose about five hundred thousand people altogether—pour their sewage into that basin, which is only flushed out once a year, when the curtains are raised. The dam raises the water twenty-one feet twelve miles below the city, and into this large basin of comparatively still water the sewage of all those towns is poured. I would ask, what is your opinion of the conditions around that district?—A. For the sake of purity, I should say the suspended matter ought to be taken out of the sewage. That river is bound to sludge up from the dam backwards. We should try and secure conditions where nothing of that sort can ever take place. It has taken place in a good many other countries, but so far our rivers are comparatively free from pollution, and we should take steps to prevent their becoming so.

Q. Do you consider the condition at Winnipeg a menace to the health of the district?—A. Nothing like a menace to the health of the district. It is nothing like what it would be if the water were taken out of the river for drinking purposes.

Q. You know that a great many people living north of the city of Winnipeg are compelled to use that water.—A. In that case it is an absolute menace to their health.

Q. That is the point. I want to ask you another question. Here is a sample of the conditions that prevailed a year ago last winter, there. They were blasting twelve

miles below Winnipeg, through the ice in the river. When they cut holes through the ice for the drills, the stench that came up through those holes was intolerable. Three of our men took typhoid. One never recovered and one lay ill for over a year afterwards. In view of that fact, is there not a great danger from the stench of the river alone?—A. I imagine those men drank the water. There is no doubt they got it to their mouths in some way, perhaps by touching their lips with fingers wet with the water.

Q. Have you arrived at any conclusion as to what it would cost to install a plant to treat sewage?—A. That is difficult to say, because if you are going to treat the sewage, you would often have to alter the whole system and that would entail a very great expense. I believe it was estimated that to purify the sewage of Pittsburgh—(population 1,000,000)—they were ordered to do so by the State Board of Health—would cost \$50,000,000. That was not for the plant alone, but for the alterations and various accessories, pumping, the distance they had to take the sewage out so that the plant would not be a nuisance, &c.

*By Mr. Murphy:*

Q. Are there any towns in this country analagous to Pittsburgh?—A. Pittsburgh discharges its sewage into a river—the Allegheny river—and the towns below take their water from that river and do not filter it. As a matter of fact, Pittsburgh refused to carry out this purification plant suggested by the Board of Health. Reports were made on it by sanitary engineers of note in the United States, and the engineers estimated that to filter all the water of the towns taking their water from the river below would cost about one-fifteenth of the cost to purify the sewage. That shows the necessity, in some cases at least, of considering the relative cost of purifying the water by filtration.

*By the Chairman:*

Q. Do you believe that you can take water contaminated by sewage in a great city and make it fit for drinking purposes?—A. Absolutely. Pardon me. Perhaps I did not get that question right.

Q. Take the city of Ottawa, for instance. Do you believe that the city of Ottawa, pouring its sewage into this river and with the intake pipe say below the sewage, could still take that water and by filtration make it fit for consumption?—A. Yes. They could, but it would not be safe to take the water immediately below, but five or ten miles below it could be done.

Q. It would be safe five or ten miles below?—A. I know it would, because five or ten miles below the pollution is slight.

Q. I want the Committee to understand this. You say you can take sewage water and purify it, killing all the disease germs. But is not the filth still in the water?—A. I do not know that you can kill all the disease germs. As a matter of fact, I doubt whether we can, even with sewage treatment, destroy all the germs. I spent several days at the Experimental Station at Baltimore, where they wished to kill these germs on account of the oyster beds below, and I looked through the daily reports made during the one and a half years of the experiments. The bacterial reduction ran, on an average, to ninety-five per cent but often ninety, and sometimes seventy or eighty. The monthly average would not be as low as that but on some days it would. Suppose we assume they could get ninety-five per cent every time. The number of the bacteria in sewage is often four or five million per cubic centimetre. But taking it at one million, ninety-five per cent reduction would still leave fifty thousand per cubic centimetre.

Q. To get pure water, then, would not the safest proposition be to try to purify the sewage before it goes into the water?—A. Yes. That would help, of course, but you must remember that some of the worst epidemics in cities have been caused where

the germs came from isolated houses on the river above, and you can never prevent that. If you had a purification plant at work in Ottawa and a heavy rain took place, the sewage would overflow and escape the purification plant, so the people down below could not depend on the water.

Q. Would you be in favour of a dual system: purification of the sewage before going in, and a filtration plant?—A. Yes. Certainly. I do not object to sewage purification by any means, but inasmuch as the object of this is the protection of health, it seems to me that taking up merely the question of sewage purification is dealing with only half the problem, and the purification of water will achieve greater results than the purification of sewage. If there is to be a choice, it seems to me that a filtration plant should be put in.

*By Mr. Northrup: \**

Q. Supposing Ottawa is pouring all its sewage into the river and supposing the water is treated in every way, so far as health is concerned. Would there not be something disgusting in Hawkesbury, say, taking its drinking water from that sewage-polluted river?—A. No. When organic matter is reduced to its elements, it loses its identity as a substance. For example, domestic sewage, bodies of plants and fruit, etc., are all composed more or less of the same elements, and after they have decomposed you cannot distinguish one from the other, so that there is really nothing in associating that idea with the organic matter from a sewage disposal plant.

Q. It would reduce the objectionable matter to its organic elements but it is still there.—A. No, it is not there.

Q. You do not eliminate it?—A. You do not destroy it. You have it in the form of gases, in the form of carbon, oxygen, ammonia and so on, but these are not disgusting.

Q. What I am getting at is the fact that despite all the treatment you still have all the original objectionable matter. It has been altered but not eliminated. I can see that there is a different substance, owing to the chemical decomposition, but is not the original matter there still?—A. For instance, take hydrogen and sulphur. They are unobjectionable unless combined in a certain way, when you get an objectionable odour. But as long as they are not thus associated there is nothing objectionable at all. The river itself carries on a wonderful purification. So long as the oxygen content of the river is not reduced the river is a great purifier itself; in fact it does what all purification plants must do—oxidize the sewage. That is what it all comes to in the end, the application of oxygen to organic matter.

*By Mr. Chabot:*

Q. Suppose cities and towns in Canada that are located on the shores of rivers and streams were compelled to take precautions in the disposal of their sewage, would that lessen the mortality from typhoid? That is a pretty hard question to answer, but do it in a general way, please.—A. That would lessen the chance of typhoid occurring certainly.

Q. Would it bring our mortality, or death rate, from typhoid, down to the ratio that they have in European countries?—A. Absolutely not by simply purifying sewage.

Q. But with the other plan added, to which you referred?—A. You mean by the filtration of water also? Yes, we could do that more easily than they can.

Q. Because our water is so pure?—A. Because our water is purer.

*By the Chairman:*

Q. Is it not a fact that these European cities you speak of, especially in England, draw their drinking water from the uplands, whereas our cities in Canada take their water from the great rivers and lakes? I understand that in the Northern part of England, and around Edinburgh, and other places, they draw their own water from the

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hills, so that they would not have the same necessity, unless they contaminate it with sewage, to purify their water that we have.—A. That is quite true. It is for that reason also that I say the decrease in the death rate from typhoid over there is not to be credited to the purifying of the sewage, because the rivers are certainly not pure from the point of view of potability.

Q. Is the lower death rate there not due practically to purer water?—A. You mean to purer sources of water?

Q. Yes, purer water for drinking purposes.—A. That they have better water is shown by their low typhoid death rate.

Q. You believe, do you not, that typhoid germs are to a large extent water-borne?—A. Yes.

*By Mr. Northrup:*

Q. What is your idea with regard to international rivers like the Detroit and Niagara. Is the prevention of the pollution of these rivers a subject of sufficient importance in your judgment to justify the two Governments endeavouring by some means to put an end to the pollution which certainly exists now?—A. I should think it is well worth while considering the subject, but as to putting an end to it, that is a matter I think which depends on circumstances.

Q. What I am asking is, is the subject of sufficient importance to justify the Governments of the two countries in taking it up and dealing with it?—A. I certainly think so.

Q. This Committee is supposed to make suggestions and we would like to have some evidence upon which to base those suggestions.—A. I think it is indeed a proper subject of inquiry.

Q. Supposing our American cousins were to do nothing along the line we have been discussing and the pollution of international waters by the discharge into them of sewage from American cities were to continue, do you think it would be worth while for us to go ahead and do our duty?—A. In that case I should still more strongly insist on protection for our water supplies by filtration.

*By Mr. Chabot:*

Q. You believe that there should be protection of the water supply?—A. Yes. For instance take the Detroit river. If a water supply on the Canadian side is taken from that river and the city of Detroit is not required to purify its sewage, it would be hardly worth our while to purify our sewage. It would be better to filter it or to abandon that source of supply altogether.

Q. What is your idea as to the relative merits of septic tanks and methods of oxygenation as regards the proper and scientific disposal of sewage?—A. The septic tanks—in fact all tanks—constitute the preparatory part of the process. The oxygenation process follows that again. That is carried out by means of bacteria of one kind and another, using contact beds or trickling filters. The septic tank is one form of the preliminary process. It does not do much more than take out perhaps one-half of the suspended matter.

Q. How about the beds?—A. The beds are chiefly for dealing with the matter in solution; if the suspended matter were not taken out they would be choked.

Q. In treating sewage you could not get along without such tanks?—A. Contact beds have choked up even with septic tanks. The tank method is really a first process. After the sewage is taken from the streets, a grit chamber is necessary for the taking out of the sand, which otherwise would get into the beds and stay there and choke them up. The same with the sludge, that is, the matter that readily settles. The septic tank is a kind of tank in which sanitary engineers hoped to be able to do more than simply take out the suspended matter. They hoped to liquify the solid matter and get rid of a part of it, which practice has shown is not done to any great extent.

There are other tanks being tried out at the present time, which promise to be more efficient than the septic tanks.

Q. What would you consider to be the best method, as applicable to Canada, for instance?—A. There is one tank in which the sludge is separated from the fresh sewage, and that is the Imhoff tank. In this tank the water passes through a settling chamber with sloping sides. As this sludge settles it slides down into a lower chamber, and there some purification takes place. Putrifaction, or fermentation, of the organic matter in the sludge takes place, and the gases as they form are tapped and do not escape through the passing sewage. In the septic tank the gases from the putrefying sludge in the bottom rise through the sewage and interfere with sedimentation, which is objectionable. In the Imhoff tank the gases as they rise escape around the sides. They are trapped so that they cannot come up through the incoming sewage. In these tanks the sludge is reduced to a state of greater density and is more easily handled. That is a question that really applies more to the practical working of the plant. The disposal of the sludge is a disagreeable and difficult matter. The Imhoff tank makes its disposal more easy.

*By the Chairman:*

Q. Are these sewage treatment plants very offensive to the districts where they are located?—A. More or less so. The Imhoff tanks are very much less disagreeable in this respect than any others, and are claimed to be practically without odour. As a matter of fact I have tested some of the sludge and found the statement to be very nearly true.

*By Mr. Northrup:*

Q. Take two towns like Cobourg and Port Hope, on Lake Ontario that are only seven miles apart, but are near Toronto. Is it not possible that sewage might be carried past Port Hope but might prove a serious matter to Cobourg?—A. Yes, the sewage might drift along the shore, but the lower city should filter its water. I think the fact that the lower town filtered its water would be a much more positive and definite protection than the purifying of the sewage of the town above.

Q. Then you think there would be danger, or enough danger, to justify the filtering of the water?—A. In that case, certainly.

Q. Would it cost too much for us in this country to do what is right and proper in order to secure a good water supply?—A. If the question of the purifying of the water is not lost sight of, and is given at least equal importance with the purification of sewage, it is possible to achieve that result without undue expense. I think the purification of water taken from rivers polluted with sewage is of such paramount importance that it should be considered before the other question. The results, in my opinion, are more positive, more definite, and more certain.

Q. If possible you would think it well to have both methods?—A. Yes, ultimately, and in many cases it is necessary now.

Q. As one witness put it the other day, a sanitary engineer could not prescribe any standard method of treating sewage because the local conditions vary to such an extent. You could not lay down the same plant for every place?—A. To install, as a commencement, a plant to take out the suspended matter, would not be asking of municipalities too much, and would go a long way in the desired direction.

*By the Chairman:*

Q. That would be, comparatively speaking, an inexpensive plan?—A. Yes, and would make it easy to apply other methods afterwards.

Q. I gather that from your experience you consider it would be necessary to make a thorough investigation of each separate locality before deciding just what remedy

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should be applied?—A. Yes. I think if there was some central body that had jurisdiction over the whole country, with officials or subordinate bodies having charge of at least the whole of a water-shed it would be very desirable. For example, in the case of the Ottawa river the water-shed should be considered as a whole, otherwise certain places might be doing less purification than others, and to make the system operate fairly you should really ask the places higher up on the water-shed to do more, than the actual necessities of the case require in order to even up with the places down below.

Q. Have we in Canada to-day any number of qualified sanitary engineers?—A. The Secretary of the Canadian Society of Civil Engineers is here, and he perhaps can answer the question.

Q. What I am getting at is this: we spend a large sum of money every year in preparations to fight an enemy we may never meet, but we are not spending one dollar, as a Dominion, to protect the people against an enemy that is entrenched in our midst, and is yearly slaying hundreds and thousands of our people, I refer to typhoid fever. Would you say that the Dominion Government would be justified in spending a large amount of money in creating and training a proper staff of sanitary engineers to deal with this question?—A. Yes, I certainly would.

*By Mr. Northrup:*

Q. In view of what you said a few moments ago when you referred to the Ottawa district, inasmuch as one half of the water-shed of the Ottawa river is in Quebec and the other half in Ontario, would it not be necessary for the Federal authorities to take hold of the matter and exercise jurisdiction in both provinces if satisfactory results are to be obtained?—A. Yes, absolutely.

*By Mr. Chisholm (Inverness):*

Q. What schools in Canada give specific training for this profession?—A. Do you mean Sanitary Engineering?

Q. Yes, or is there any school in Canada at which that training is given?—A. There is the School of Practical Science in Toronto. Also Queen's, McGill and Laval Universities. -

Q. I know, but I have reference particularly to a course in Sanitary Engineering?—A. No. Sanitary Engineering is a specialty. It is taught at present under the head of municipal engineering as a branch of civil engineering. I think, however, that we have engineers qualified to deal with these matters.

*The Chairman:*

Q. Are they in sufficient numbers?—A. I should think so. There is certainly a sufficient number at the present time, but if the Government by the legislation proposed enlarges the field of work there would quite an additional demand for men. There is a good deal more being done in this line at present than there was a few years ago.

Q. Could the Government, from your experience, be of any assistance in equipping Chairs in different universities for this particular subject?—A. Yes, I think that would be money well spent, because up to this time the field for purely sanitary engineers—that is men who deal with the subject from the specialized point of view, in this case the disposal and purification of water and sewage—has not been great enough to justify the creation of a single department at our universities. No doubt that result will follow if the Government subsidizes or endows a Chair in each university. That would not be a serious matter from a financial point of view but it would be a very good thing to do.

Q. You think it would accomplish good results?—A. Certainly, and it would not require very much money either.



*By Mr. Chabot:*

Q. Do you suggest that that should be done?—A. I would be very glad indeed to see it carried out.

*By the Chairman:*

Q. We are dealing entirely with the matter from the standpoint of providing pure water for the people of Canada. Now, in order to carry out the desired object some of us think it would require a trained staff of men, trained for that special purpose, who know the conditions and would be able to offer proper advice to the different municipalities.—A. Do I understand that these men would be employees of the Government?

Q. They might or might not be. Let me ask you this question: Would you consider it wise that the Government should create a staff of Sanitary Engineers in Canada to take control of the whole situation that we have been discussing?—A. If the whole of these men were to be placed under a single body, if that is possible, it would involve the oversight of the water supply in districts all through the country. That should be directly under the authority of the supreme body referred to, and these supervisors should be trained as sanitary engineers, or, at any rate, as sanitarians. That means as much training in biology, chemistry and other subjects as it does in engineering.

Q. These men in order to be able to act intelligently and to determine how the law should be enforced should be trained men, they should be conversant with the whole subject of the building of water purification and sewage treatment works, and be able to advise municipalities on the subject.—A. For the enforcement of any Act that may be enacted I think that is very necessary.

*By Mr. Northrup:*

Q. I suppose that local medical men, or local engineers, would be competent to carry out the orders given by the central board that has been referred to?—A. That is local engineers who have made a speciality of this branch of engineering.

Q. Do you think that if such a Board were created, with trained officers, and was operating efficiently, its labours would affect the death rate?—A. Yes, it would to a very great extent. There is a fine field for such a body.

Q. Can you give us any idea as to what the probable diminution in the death rate from typhoid would be if the Government took hold of this question and dealt with it systematically and successfully?—A. I think it would reduce the death rate to one third or one fourth. Not only would the average death rate be reduced but the danger of epidemics would be greatly diminished, and in many cases would be prevented altogether.

*By the Chairman:*

Q. Is there anything else you wish to say?—A. There is something I might say in connection with the training of men for the purpose of administering and enforcing the legislation that is now proposed. Something along that line has already been done by the Board of Health of the Province of Quebec. Some years ago, for the position of sanitary engineer for that Board we employed a young man who had been trained in an American College in that special narrow branch which comprises partly engineering, and partly general sanitary science, to act for us. At the same time we selected a graduate of one of the universities, in civil engineering, and sent him to the Massachusetts Institute of Technology to take lectures and a course of sanitary science there. We paid his expenses and his fees at the Institute, and at the same time employed him during the summer vacation, which is four or five months to work in connection with the young man from the American College, with the idea of the former taking the latter's place as soon as he was

MR. R. S. LEA.

qualified. The idea of that was to give him practical experience at the same time as he was getting his training there. The young man in question spent three years at the Institute of Technology taking that course and acting with the American Engineer during the summer, and now he has taken the latter's position himself. We have done that because there is not given in any University in Canada such a complete course as some two or three Institutions in the United States give.

Q. That would emphasize in your mind the necessity of something more being done in Canada?—A. Yes.

Q. To broaden out the course.—A. Yes. If we had a course of that kind here we could begin immediately to train men in this country and they could be employed in subordinate positions during the summer months while taking their university course.

Q. How long would it take to train men for positions of that kind?—A. Not very long. It would be very useful if the student should combine the practical and theoretical courses in the manner suggested. Of course we would not necessarily expect a man trained only in this exclusive line to be an engineer in the sense that he would be fully qualified to design plants in detail, but he would know from an engineering as well as from a sanitary point of view what is wanted.

*By Mr. Northrup:*

Q. And he would be in a very much better position to learn than a man who had not had that experience?—A. Very much better.

Q. Are there any Canadian universities which grant D.P.H.—the Diploma of Public Health?—A. Yes, to medical students. The young man I spoke of is a graduate of Laval and had taken the civil engineering course as given in that university, before he went to the Institute of Technology.

Dr. HODGETTS.—And he has turned out as excellent man.

The CHAIRMAN.—Well, Mr. Lea, you have given the committee most valuable information, for which, on their behalf, I desire to thank you.

Witness discharged.

Mr. JOHN KENNEDY, Montreal, sworn and examined.

*By the Chairman:*

Q. You are a civil engineer?—A. Yes.

Q. You have given a good deal of thought, I suppose, to the question of sanitation?—A. Yes, I have, that is in its broad general lines.

Q. Are you connected in any way with the municipality of Montreal?—A. Not at present. I have been connected with it.

Q. Will you tell us what your engineering experience has been?—A. I was at one time Deputy City Engineer of Montreal, and my particular work was the building of sewers and looking after the sewage of the city. That was a good while ago. Since then I have reported on matters in connections with the city sewage for the municipality, as an engineer of the harbour commissioners. More recently I have been associated with the preparation of Canada's case in connection with the Chicago drainage scheme, and, with my friend, Mr. Lea, made a report to the Canadian section of the International Waterways Commission.

Q. Perhaps you might give us your ideas on the subject we are investigating, and then if the members of the committee desire to put any questions they may do so.—A. I fully agree with Mr. Lea in all that he has said. I would like, however, to make perhaps a little more clear distinction than there seems to be as to the difficulties between what may be called a state of nuisance in a river, and having that river in a condition for domestic use as a matter of hygiene. I look upon it—and Mr. Lea has

made it, I think, clear—that in a populated country it is wholly impossible to keep our streams, big or little, in a condition fit for domestic uses—quite impossible—as a matter of actual practical usage. We might make incorporated towns and cities do something, but there would be the hamlets, and the factories, and the isolated places and the sewage on farms, and other things, which would pollute any stream running through a populated country. There is no possibility of getting pure water for drinking purposes if we consider the question in that light. Your Committee, I understand, is dealing with navigable waters.

Q. Or with their tributaries.—A. One would suppose that suggested some reference to navigation. Now, navigation is another affair. The questions put to Mr. Lee suggested that what was in the minds of the Committee was the hygienic condition of the health of our people.

Mr. MURPHY: Might I interfere in order to suggest that Mr. Kennedy would be justified, would he not, in treating the question as if this Committee was not limited in that way at all.

The CHAIRMAN: Yes, we want Mr. Kennedy to discuss the question from its broadest standpoint.

The WITNESS: It ought to be, that is the fundamental question. Now, if that be the fundamental question as to what is the problem of obtaining wholesome water for domestic purposes, for all the purposes of a city, then, as Mr. Lee has put it, filtration is the prime thing. We cannot but admit that as a fundamental condition. We cannot get our streams, big or little, in a condition to be entirely wholesome as they stand with raw water, as it is called, and filtration is almost without exception a necessity to obtain thoroughly pure water.

Q. We are now drawing our water supply in many cases from rivers.—A. From rivers which drain the populated country. As an illustration, you are no doubt aware that Ottawa has been recommended to go up to the sources of the Gatineau for its water supply—that means the whole inhabited country there—and to buy up the whole place so that there shall be no inhabitant or no domestic animal belonging to any man in that section, that the water shall be wholly and entirely pure. To secure that result means that it must be an unpopulated place. This is impracticable in parts of the country where we have farms, population, and other conditions of settlement, so let us understand at once, then, that with such conditions we cannot keep the streams in a thoroughly wholesome condition for drinking purposes.

Then what would you do about it? It certainly is cheaper, more effective, and safer in every way to filter the water we are going to use, except in the case of big cities on small streams, and we have hardly a case of that kind in Canada with the exception of Winnipeg and perhaps a few other exceptional places. There are a few of our rivers that are fit to drink without filtration. Montreal is taking its water now from the purest part of the St. Lawrence within reach, but considers it necessary to filter it as observations show that the water is not what it ought to be. If that is the case with regard to the St. Lawrence, it applies to all other rivers into which a large city discharges its sewage, and especially in regard to the lakes, because, up and down the margin of a lake both above and below, there is practically no current, and the whole margin of the lake in the neighbourhood is so polluted that it has to be filtered, as is being done now in Toronto; but on the Ottawa River and other places the dilution is so great that the river is not affected for all practical purposes. It is not hurt in any way, for ordinary use, but it is unfit for drinking purposes without filtration. The purification of water by purifying the sewage and by filtration afterwards involves a double operation, and if we take very impure water and double treat it, we can reduce it to any extent.

Mr. JOHN KENNEDY.



*By the Chairman:*

Q. If you purified the sewage in the first place before going into the water, would not that aid in getting pure water?—A. In that case you would have to treat a great quantity. There are cases where that should be done, but, generally speaking, it would not be necessary. It is cheaper, more direct as a practical proposition, and more effective to take the water that is wanted for domestic purposes and thoroughly filter and sterilize it than to treat the whole sewage.

Q. Take the City of Ottawa, for example. Your argument would be that the city could safely and more cheaply provide proper treatment for the water by filtration. What would you say about the municipalities along the river?—A. Take Hawkesbury and Ottawa and add them together. It would be cheaper for Ottawa to pay for the filtration of Hawkesbury if it is responsible for it. The quantity of sewage is so small, and the dilution so tremendous that it would be cheaper for them to do their own filtration. That is looking at it in a broad way. It would have to be settled in each place, and, speaking in a general way, it would be cheaper and safer for these different places to filter their water.

*By Mr. Murphy:*

Q. Cheaper than what?—A. Cheaper than to compel Ottawa to completely sterilize its sewage for the benefit of these small towns. As to who should bear the cost, that is another matter, but as a practical proposition it is vastly cheaper and safer to the country that each place should do its own filtration.

*By the Chairman:*

Q. I gather from what you say that we can still continue to deposit the sewage of our great cities into the rivers and lakes and depend for pure water entirely upon filtration?—A. Broadly speaking, yes. In the case of Lake Ontario, the St. Lawrence and Ottawa Rivers, certainly.

*By Mr. Northrup:*

Q. Can we do that in the case of the Thames in Ontario?—A. The water below the waterworks in London is pretty bad. That is a case that would have to be considered. The Thames is a flat river, with very little fall. There may be cases where it would be proper to require some purification of the sewage to at least get rid of the sludge.

Q. In other words, each watershed would require its own peculiar treatment. A. Precisely. It would depend on the locality. I might say that we had very little time to study this question with relation to the question that you might put to us, as it was not until a day or two ago that we had any idea we should be required to come here. What has been clear in my mind for a long time is that we should have some Federal authority to control this matter. Our conditions are so complicated. For instance, the Ottawa river is an interprovincial one and the St. Lawrence is an international river, and it seems to me that we should have some body created by the Federal government to deal with the whole matter, just as the railway commission deals with transportation problems. There should be some body of that sort and then perhaps some sub-division whereby the local bodies could deal with their own matters in a more detailed way, but surely the first thing would be to see that the water supply taken into the waterworks is of the right sort, and that no waterworks should be made or continued to be used without the sanction of some board of health which should be created for that purpose, with strong powers. Such a board ought to be very carefully constructed, because conditions are such that it would be largely a matter of discussion as to the application of their powers. For instance, McGill University has a professor of hygiene, whose business it is to study scientific questions of bacteriology, and such a man ought to be on the board, associated with the engineers. The duties of the

engineers would be mainly in the line of estimating cost of construction and maintenance of apparatus. The professor of hygiene would prescribe the results to be attained and the two, working together, would attain the best results.

*By the Chairman:*

Q. Is there any obstacle to combining the two in one man?—A. This is a time of specialization. For instance, doctors are all divided up into surgeons, general practitioners, eye and throat specialists, and some go down to the feet. I think probably the best results would be attained by specialists, each following his own particular line, but working together for the same result.

Q. My conception of a sanitary engineer is that he should combine the knowledge of an engineer with a training in hygiene.—A. I think he could devote his time better to what might be called the engineering department.

Q. Would it not be well to have a Chair in our universities to turn out men with a knowledge of both branches?—A. I would not like to have a conclusive opinion on that. It might be a good idea, but it strikes me, offhand, that it would be better for the two to work together rather than combine the whole knowledge in one man's head.

Q. Of course, you have had experience. You were speaking a moment ago of the practical result of Ottawa dumping its sewage in the river: that they could treat their own water and other people treat their own water. There is this broader question, which is of course a legal one. Is it right that the city of Ottawa should poison the water that I am going to drink two miles further down the river?—A. That is a matter of law. Perhaps it is not right. But is it reasonable, as a practical question, as a question of government administration, that Ottawa should be compelled to go to an enormous expense to do something which one man or a small community might itself do for a fraction of the cost?

The CHAIRMAN.—That is the question.

*By Mr. Northrup:*

Q. Would it not be possible for a central board to apportion the cost between the towns just as the Railway Commission does?—A. Certainly. Such a central board should take the initiative and say to Hawkesbury or any other small town, you must build works thus and so. Another way would be for the municipalities to submit their plans to a board of health and get permission to proceed with construction. Something of that kind is done in Ontario. The board of health does not design the works, but they say whether they are of a kind to be permitted. They have experience in that matter. Somebody, at least, should have authority to go to a city and take the initiative in compelling the proper carrying-out of the necessary works. As I understand it, the Railway Commission does not take the initiative. They wait until somebody makes a complaint.

M. NORTHROP: I do not suppose it would make very much difference. The Commission will listen to anybody, and if any individual takes enough interest in a question, he can always be heard by the mere writing of a letter to the Commission.

The WITNESS: It should be something of that kind, but I would not like this to be considered as my conclusive opinion.

*By the Chairman:*

Q. You spoke a moment ago about Boards of Health. You have had experience with Boards of Health in cities and municipalities. They are as a rule, I suppose, composed of medical men, whom, no doubt, you have met in connection with these matters. Does their training fit them to take charge of work of this kind without other training?—A. I would hardly like to make a positive pronouncement on that. Some of them, I think, are hardly qualified, but the manner of their appointment should be such as to ensure only competent men.

Mr. JOHN KENNEDY.

*By Mr. Murphy:*

Q. What class of officials are you referring to?—A. Medical officers in connection with Boards of Health. We have such a Board in our municipality, and my experience of such men is that they know practically nothing of the scientific part of the question that we are dealing with, and that is why I suggest that properly trained men, in sanitation, should be secured. That is no reflection on the medical men at all. The whole sanitary science has grown extremely rapidly and the older men, both engineers and doctors, have hardly kept pace with it. They have been busy with other things. Our railway engineers do not need to trouble their minds at all about it. They have other questions that keep them exceedingly busy and the ordinary practitioner in the country understands that bad water hurts people, but what way to get rid of that bad water he is not prepared to say; but surely men ought to be trained in this science, which has grown so rapidly. Our pollution is increasing very fast and we understand so much better now what is needed to make wholesome water and wholesome conditions of health generally. Some kind of scientific training is urgently needed.

*By the Chairman:*

Q. You think it would be in the interest of the country that some step should be taken to create properly trained sanitary engineers?—A. I do. I can conceive hardly any other way in which money could be better spent than to take steps for improving our whole sanitary condition, and of course, trained men would be the first step.

Q. Do you consider that to secure such men it would be necessary for the Government to take action in the way of creating Chairs in Universities?—A. I think so. You would have to start with young students, and it would be quite a while before they would grow into experienced engineers. A young man out of college may have had experience in his vacations or at hospital work, or if he is an engineer, on survey work or something of that kind, but he is still a young man and it would take some time before he would become qualified as a sanitary engineer. It would be necessary, in creating such a Board as I have mentioned, not to wait until these students had grown up, but select the very best men available at present.

Q. Would this not be possible: to draw from the staff of civil engineers and give those men a course?—A. Not exactly a course. They should have some education. Suppose you were to create a whole Board analagous to the Railway Commission. After the men were selected the first step in their training would be to send them out to see what is being done at present in the different places of the world in this line.

*By Mr. Murphy:*

Q. Should they not have that training before they get their appointment?—A. Of course they should have. I am referring to the present condition. I say that we ought not to wait until a body of sanitary engineers has grown up or been trained.

Q. We ought to make a beginning in the way you suggest?—A. Yes, with the very best material we can get. If a man were starting a large machine shop or factory, he would send his experts to examine the best things in existence in that line at present and then begin at that point with his own plant, and so it should be in this case. A Board should be given powers and permission to go and see what is being done elsewhere and what has been successful.

Mr. NORTHRUP.—That is exactly what Japan did. They sent men over all the world to study the best firms.

*By Mr. Northrup:*

Q. Do you think, if we could materially improve the domestic water supply, we would materially affect the death rate?—A. Of course, but what is the best way to do that. How are we to get the water pure at the water tap? Are we to begin at the



sewer or at some intermediate point between that and the tap? Suppose you absolutely sterilized the water of the city of Ottawa. That is not the end of it all. The Ottawa river would still be unwholesome to a large extent. The farms and the isolated dwellings along its banks would still discharge their sewage into it, and that phase is becoming more acute all the time.

*By Mr. Murphy:*

Q. I understand you to say that in your judgment the prime requisite for pure water under present conditions is filtration?—A. Exactly.

Q. Would you be good enough to tell the Committee whether, in your opinion, there is any one method of filtration which is best in every case, or whether a different method should be adopted in different cases?—A. I think different cases would require different methods. There is rapid mechanical filtration and slow sand filtration, and it would depend on the case which method to apply.

Q. You are pretty familiar with conditions in and about Ottawa. What kind of filtration would be best for Ottawa?—A. I happen to have designed a good part of the early waterworks of Ottawa.

Q. I am aware of that. Are you prepared to say which method would be best?—A. Probably sand filtration.

*By Mr. Warnock:*

Q. I understand, from your remarks, that you would consider a Board of Health competent if it were composed of say a sanitary engineer and a bacteriologist. Would you consider that more effective than if we had a combination of both qualities in one man?—A. I think so; on such a tremendously important question I would not trust to the judgment of any one man, because all of us have our idiosyncrasies, and may get away from the mark sometimes.

Q. Two specialists would be better?—A. Two or three. The health of the whole population is an enormous question, too big a question for any very small number of men to deal with.

*By Mr. Northrup:*

Q. In your judgment, is there any question before the people of Canada to-day more important than the securing of pure water?—A. I do not know that there is. It is an enormously big question and I know of nothing more important than the securing of a pure water supply.

Mr. WARNOCK.—In Great Britain the degree of D.P.H. (Doctor of Public Health) is insisted upon where a public health officer is appointed to look after water supply and sanitary conditions in large cities. Is there a similar degree in this country?

Dr. HODGETTS.—Yes. McGill, Toronto and Queens all give such degrees. That is purely to medical men.

Mr. WARNOCK.—It is not necessary to have any knowledge of engineering?

Dr. HODGETTS.—The lectures of Professor Starkey of Toronto deal in a broad way with engineering questions relating to public health, but he does not deal with them as an engineer. That is left to the Professor of Engineering. He simply shows the sanitary part of it. But in Great Britain it is essential for a man to be a medical officer of health.

Mr. WARNOCK.—I think it is compulsory.

Dr. HODGETTS.—Yes. It was made compulsory two years ago or so.

*By the Chairman:*

Q. Is there any other statement you would like to make to the Committee?—A. No, sir, nothing.

Mr. JOHN KENNEDY.

Q. The Committee are very much indebted to you for your attendance and the valuable information you have given. On their behalf I wish to thank you very heartily.—A. Let me say that I shall be pleased to be at your service any time you want me.

Q. The Committee are desirous of getting all the information they can and will be glad to call upon you when your services are needed.

Witness discharged.

Dr. HODGETTS.—Mr. Chairman, Mr. McLeod is present from Montreal. He may not be in Ottawa again very soon, and I would be very happy to step aside in his favour.

Mr. McLEOD.—I have not come up in connection with this investigation, because I am not a sanitary engineer.

The CHAIRMAN.—We will be very glad to receive any information you can give us.

Mr. C. H. McLEOD, Montreal, sworn.

*By the Chairman:*

Q. What position do you occupy?—A. I am Vice-Dean of the Faculty of Applied Sciences in McGill University. What I thought I might say, as you were kind enough to ask me, would bear on the educational questions that you were asking. The establishment, or rather the development of our courses in the direction of sanitary engineering is one that has been under consideration. We have for many years had a course of civil engineering which Mr. Lea really founded, or was the first professor of. That has been tending to broaden and the question now as to the more complete development of that course in the way of making it necessary for the engineering students taking also biological courses so that they would, as you have put it, combine in one head a complete knowledge of the questions which you are discussing—that is the point that we are actively considering, and we will be glad indeed to have any light which would enable us to more completely develop that course.

Q. Would you consider, from your experience that in the interest of the country the Government should take some action along this line to assist in this work, or is the University itself in a position to do it?—A. The University, of course, always aims to train its young men with a view to making them as useful as possible, having in view the requirements of the country, and if the need for complete sanitary engineering training were more developed than it is at present I think the University would develop the courses in that direction. If, however, the Government were to give aid in that direction, it would accelerate us to a very great extent. I agree with Mr. Kennedy that it is not possible to start out in the world a full-fledged sanitary engineer from college. He must have some practical experience before he can be a really useful man as the head of a department in responsible charge. You are perhaps to legislate for years in advance, and the educational part of the subject you are to deal with, is one that should not be neglected.

Q. We must have theoretical as well as practical knowledge?—A. Yes.

*By Mr. Northrup:*

Q. From your experience with the young men at your University do you think it would have a beneficial effect in the way of getting brainy young men to take up this study of sanitary engineering if the government had some Department in which there were positions and prizes to be gained?—A. It certainly would by directing their attention to the fact that there was a career of that kind open to them, and

the establishment of a Government Department would, of course, advance the status of that branch of the profession generally because municipalities and cities and towns would more and more require men with such training to advise them.

*By Mr. Murphy:*

Q. Particularly if, under the suggested central authority, a certain standard of qualification was required.—A. Undoubtedly.

*By Mr. Beland:*

Q. As far as earning a living in this country, the prospects of sanitary engineers are rather poor, are they not?—A. A man must grow into the profession gradually, as Mr. Lea has done. He does not look emaciated as a result of his experiences.

Q. How many sanitary engineers are there in Canada at the present time?—A. That would be an impossibility to answer.

Q. Are there approximately one hundred?—A. I have been asked similar questions to that in a court of law. Judging by experience it is a bad thing to begin answering such questions. Speaking generally there are a number of qualified engineers in the country, but necessarily not a very large number of men who have devoted their attention exclusively to that subject.

Q. In your opinion what is the reason that young men have not turned their attention to this branch of science?—A. I suppose because they did not see a sufficient field in front of them.

*By Mr. Chisholm (Inverness):*

Q. Do you not think they are turning their attention more to the subject than they have done in the past?—A. Undoubtedly, and in the American Colleges there are distinct courses for the education of sanitary engineers.

*By Mr. Béland:*

Q. You are connected with McGill University?—A. Yes.

Q. How many young men have you in the University at the present moment who are applying their whole attention to that branch of engineering?—A. We have no course of sanitary engineering exclusively. Our students in the department of civil engineering take that as a portion of the work necessary to obtain a degree in civil engineering.

*By Mr. Chisholm (Inverness):*

Q. Is it not true that you have some medical men, who have taken the special course. He was a graduate of McGill. MA. You are speaking of a medical degree?—A. MacDonald of Nova Scotia, who came up to your University and took a two year's course. He was a graduate of McGill.—A. You are speaking of a medical degree?

Q. No, of the course given in hygiene, in public health.—A. Doctor Hodgetts would know that better. There is no education in sanitary engineering given as such, it is very general.

Mr. CHISHOLM (Inverness).—There are medical men who take a particular course in that line.

*By the Chairman:*

Q. In replying to a question from Doctor Beland a short time ago you said that the reason why more men were not seeking to be trained as sanitary engineers was because there is no field. Will the fact that the Dominion Government are awakening to the necessity of taking some action have the effect of inducing young men to take this course?—A. Without question it will.



Q. Have you any suggestion to make along the line of developing first class men, more quickly than we can at present, and rendering them available for this work?—A. I should think that what Mr. Kennedy has said in that connection is the only practicable course at the present moment. That is that you select civil engineers, who have good qualifications as such and for the time being make use of them. In the meanwhile develop your young material so that they will grow up perhaps into better specialists than their predecessors were.

Q. You realize that this is a young country, and we will have to initiate a lot of work of a scientific character.—A. I am certainly a firm believer in promoting our own engineers in Canada. At the same time I would like to see the importation of the best possible talent where that is required.

*By Mr. Northrup:*

Q. Assuming that the Government decides to carry out some of the things that we have been discussing—that is the appointment of a central authority to supervise the securing of a better water supply—can we rely upon the Universities—for example take McGill—to establish a chair of sanitary science, or would it be advisable that the Government should contribute to that end?—A. The University might come to the conclusion that its funds could be better applied in other educational directions, but if the Government were to offer to subsidize a chair then there would be no doubt whatever about the institution of that chair. In the management of the University it is a matter of doing that thing which is most needed, particularly in Canada, because our funds are not sufficient to meet all the demands that are made upon us.

Q. I presume there is at the present time hardly such a demand for this particular chair as to justify you in incurring the necessary expenditure?—A. Hardly. It is a matter that is just beginning to be considered as a complete course in itself.

The CHAIRMAN.—I am sure we are very much indebted to you, Mr. McLeod, for your very interesting information.

Witness discharged.

Committee adjourned until Wednesday, May 21, 1913.

WEDNESDAY, May 21st, 1913.

The Committee met at 10.40 o'clock, the Chairman, Mr. Bradbury, presiding.

Examination of Dr. Hodgetts continued.

*By the Chairman:*

Q. At what point in your evidence did you stop the other day?—A. Just on the question of pollution.

Q. Will you explain the diagrams which you then produced?—A. I fully explained those diagrams in regard to the death rates in the various cities in Canada when I was last before the Committee, and I do not suppose it is necessary to go over the figures again. You will remember that I promised to have the figures brought up to date.

Now let me deal with the question of pollution of our lakes by sewage. In 1907, under the Provincial Board of Health of Ontario, a series of examinations were made as to the effect of the wind on Toronto Harbour carrying the sewage

out into Lake Ontario and so affecting the water supply. The diagrams I have here (pointing to diagrams) indicate how, for instance the sewage was carried out through the eastern gap and then up along the front of the Island.

Q. How far would that sewage be carried out?—A. It is five miles in a westerly direction from the eastern gap to this point (indicating). You will observe that the action of the sewage under the influence of the wind is like the opening of a fan. You will notice that at this point west of the eastern gap (indicating) the sewage is carried out over the lakes. These experiments were carried on for about three months, the officers engaged going out regularly and taking samples. I went out sometimes myself, but Doctor Amyot was in charge of the whole of the work. Here (exhibiting sheet) you have a very interesting diagram showing the bacterial contents of the water at a distance of three miles south.

Q. How far is that from the city?—A. That was three miles south of the Island just out of the eastern gap, on the route taken by the boats going to and coming from Niagara. Sample 13 shows the colon present in the water at a distance of three miles south.

Q. Is that surface water?—A. We found that the bulk of the sewage itself is lighter and also warmer than the water of the Lake. It rises to the surface and just floats in a well defined direction like the course of a river. You could go along in a tug and could tell when your tug was running in sewage and when it was in the clear Lake water. The distinction was quite marked even as far down as off Scarborough Heights.

Q. How far can you trace the sewage in the Lake?—A. It is some years since I left Toronto but I believe pollution has been found at a distance of fifteen miles out on the Lake from the city, that is the colon bacillus. I am giving you this information for the purpose of showing the various methods that have been followed out.

Q. In the light of your investigations, and with the experience that you have acquired, how far would sewage be carried from the point of deposit in the water at Toronto?—A. We have traced it by bacteria examination and found the colon bacillus, which is the indicator, fifteen miles out in the Lake.

Q. I have read somewhere that investigators have traced sewage fifteen miles out, in the body of the Lake, and that they ran right into it in a tug.—A. No, not that it was visible to the eye. It would depend upon the volume of sewage that was coming out from a trunk sewer, and also as to how the wind would carry it. I found that the wind at Toronto would sometimes carry the sewage out of the eastern gap and a larger proportion, sometimes, out the western gap. It is quite evident that that sewage may be carried a great distance. As a matter of fact, outside Toronto Island I have seen human faeces floating in the water, as we have been passing along in a tug; you could take a net and scoop it up. This may be seen for a considerable distance. There is the danger not only that this may be drawn in through the intake pipe of Toronto's water supply, but that vessels as they pass along may take it up in buckets. There is no definite information as to how far the pollution may be carried, but undoubtedly it has carried a great distance. With the naked eye I have seen the pollution in the water five miles out, and the colon bacilli were present.

Q. According to this evidence, the water taken by Toronto from its present source must be endangered?—A. Yes, it is contaminated and may be specifically infected with typhoid at any time.

Q. How far is the intake pipe from the city?—A. It is only a comparatively short distance from the Island. There is the intake pipe (indicating) a short distance away.

*By Mr. Steele:*

Q. What is the date of the report you are dealing with?—A. 1908.

The CHAIRMAN.—It is the report of Provincial Board of Health of Ontario.

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Dr. CHARLES A. HODGETTS.

The WITNESS.—I brought that report because it deals with work done while I was in Toronto and that work has been further elaborated since I left there.

Now I would like to make a short reference to pollution in rivers. Sarnia is an example that while you have the current running past the town in a South-westerly direction, yet there is a back eddy which will even carry a vessel up and land it if the vessel is floating above the water intake. There was a vessel wrecked some years ago and it was carried up on that back eddy. In the case of the St. Lawrence I have seen sewage deposited below the water intake of a municipality carried by the back current up along the shore, and there was a possibility of that sewage even contaminating the municipality's own water supply. This is a common experience.

*By the Chairman:*

Q. It is not possible, by reason of the depositing of sewage in our rivers, to take water from them and be absolutely safe?—A. Not at all. We do not know when sewage pollution takes place, and before that takes place, you may get the gross infection carried into your water supply, and particularly along the St. Lawrence. It may be carried down from one town to another because the river flows so rapidly, and many municipalities are taking their water supply from the St. Lawrence.

Q. Do you agree with the evidence given by Mr. Kennedy the other day when he practically stated that the dilution made the water fairly safe to municipalities at a distance of twenty or thirty miles below Montreal?—A. As a sanitarian I cannot accept that. That is endorsing the theory of nature doing the work of treating sewage. We have sufficient examples in Canada, and all over this Continent, clearly showing that while it may be right in theory and practice in some instances, in the majority of cases it is not safe to rely upon it. I think it is manifestly unfair to throw upon nature or Providence, what we should do ourselves. Every individual householder has to care for the sewage of his household, whether it is dry sewage or whether it is wet sewage, but particularly the former. I think the Body Corporate should do what the law requires of the individual in every Province in Canada—treat its waste.

*By Mr. Steele:*

Q. There is always an uncertainty connected with that anyway. While at a distance of twenty miles down the water might be perfectly safe for 364 days out of the year, on the 365th day, owing to some new conditions arising, the water there might become contaminated.—A. Yes, and as sanitarians we take no chances. Take the Ottawa River where the city deposits its sewage down towards Rockcliffe. Now Rockland and other places are situated along the shore farther down and in years gone by, when I was Health Officer of Ontario, I was quite satisfied that the typhoid cases at those places were due to the discharge of sewage by the city of Ottawa into the river. It was then a large amount of sewage and it is increasing. In the case of dilution by large bodies of water, in order to have proper treatment, you must consider the falls and cascades and the breaking up of that sewage so that you may get the requisite amount of oxygen in the water, and the other conditions essential for successful treatment. You must have the natural conditions where the sewage can be broken and the water must flow at a certain rate so as to permit of that. Consider the Niagara River where you have Buffalo, Tonawanda and Niagara Falls all pouring their sewage into it, and you have even Niagara Falls on the American side dumping its garbage into the river; they do not destroy the garbage, they simply dump it in. We know that in years gone by the people who drank that river water certainly had intestinal troubles and there were some cases of typhoid. The sewage is not treated, it is simply mixed up.



*By Mr. Warnock:*

Q. The contaminated water which passes over the Falls is not to a great extent, in your opinion, purified by the excessive oxygenation?—A. I do not think there is sufficient time in the rapid progress of the river to bring about that result.

Q. But I have understood the water below the Falls was much purer than the water passing over the Falls on account of the excessive oxygenation?—A. It would be relatively purer. At the same time it would not be purified, even in that great body of water, and it certainly is not purified in going through the cataract, below the Falls.

*By the Chairman:*

Q. I would infer from your evidence that in your opinion, in connection with the disposal of sewage from our great cities, not only should the sewage be purified before it goes into the water, but it is actually safer to purify the sewage than to purify the water after the contamination has taken place?—A. I think it is proper to have a degree of purification. It is proper in every case to require some treatment of the sewage, but as to what extent is the question. You cannot set up a standard as to the amount of pollution to be taken out in each case. The local conditions have to be carefully studied and their relationship to the water supply determined.

Q. Then you think there cannot be a purification standard for sewage?—A. No. May I give one example on that point. Take the town of Sudbury, in Northern Ontario, which today has a population of 5,000 or more. They take their water supply from the Lake close to the town but they carry their sewage into another drainage area altogether, and that river—the Vermilion River, or a branch of the Vermilion I think it is—runs through a country which is really a wilderness into the Georgian Bay. Now that town might properly be required simply to put in a plant providing merely a straining of the sewage so as to remove the grosser material.

*By the Chairman:*

Q. How would it be if settlers were living there?—A. In that case I would say that the central authorities should inform the municipal council of Sudbury: 'At present you only strain the sewage. In future you must provide for a further treatment of it to our satisfaction.'

Q. Would that entail any change in the sewage system?—A. Not if it was known to the engineers that you were working on the general principle that you might require every municipality in Canada to treat their sewage. The whole system could be constructed with that object in view. For instance you put your septic tanks on a given level and then you provide for construction later of bacteria beds, the only addition would be secondary treatment after the liquid material leaves the tanks where the solid matter collects.

*By the Chairman:*

Q. Do you think provision for the disposal of sewage should be made in every case?—A. I think so. The engineers should understand, at all events, that it might be required. Under the new Act, when a municipality in Ontario seeks power even for the extension of sewers, it is informed that it may be required at some future time to treat its sewage.

Q. Can you give the committee any idea of the extra cost it would entail to treat that sewage before going into the water?—A. That is a little difficult to answer, but perhaps I can do it in this way. The straining of the sewage for the removal of the grosser pollution is a mechanical process and comparatively easy. The great expense in sewage disposal begins with the second treatment, where the sewage is placed on bacteria beds or beds of a similar kind, to remove the polluting material from the sewage. That is the most expensive part of sewage treatment.

Dr. CHARLES A. HODGETTS.

*By Mr. Steele:*

Q. How would our winter weather affect that?—A. I have here in my hand the answer to that. Birmingham was mentioned the other day, (and we all know what English weather is) and I have here a report on their large filter beds, together with a picture. I think this picture (showing land covered with snow) will answer your question.

The CHAIRMAN.—They have but little frost there.

The WITNESS.—If they have such difficulty in a comparatively mild English winter, what trouble would we not have in our Canadian climate!

*By Mr. Steele:*

Q. Our severe weather practically puts beds out of consideration?—A. Unless in many instance they are covered. In Germany, which has severe winters, they are experimenting along that line in the treatment of sewage in a few small towns at present, but it is only in the experimental stage. We will have the experience of Saskatchewan cities before long, as to how their plants are working out, but I am satisfied that in many parts of Canada there will have to be a certain amount of protection for the beds. In some places, even in Great Britain, they have gone so far as to warm the beds in the experimental plants they have installed there, so that the treatment of sewage can go on despite the frost. That, I think, is another evidence that the whole question of sewage treatment has not reached a finality. Sanitary science, both in chemistry and bacteriology, like any other branch of science, is progressive, and that is evidenced in every plant that you visit. Take the city of London, England, which treats its sewage to-day with lime. It is now carrying on experiments to see whether they cannot get a better purification of their sewage.

Q. Would you say that up to the present any practical method of treating sewage that would be within the means of a small Canadian municipality has been found?—

A. So far as I know, the plants in Saskatchewan have been working satisfactorily. In that connection, I might refer to the *Public Service Monthly*, published at Regina by the provincial government, which contains an article on the work that is being done in connection with the pollution of streams in Saskatchewan.

Q. What method are they pursuing there?—A. I will just read from the report:—

“The Bureau of Health has continued to impress on all municipalities the grave lesson to be learned from the lack of foresight of older communities, and our towns and cities have been quick to realize that a system of sewage is not a convenience but a sanitary necessity, and that the very object aimed at in its installation, namely, the protection of the public health, may be defeated if some efficient treatment is not provided to render the effluent incapable of supporting the germs of disease.

As a result of this policy, there are at present eight sewage disposal plants in operation in Saskatchewan.”

I think that is splendid work for such a Province.

“In seven of these installations, the sewage is treated by biological filtration, in addition to sedimentation, and a filter is being added to the remaining plant this year.”

That is to say, after sedimentation had removed the grosser part of the sludge, the sewage was further treated by biological filtration.

“Further, plans for ten additional sewage disposal installations for various towns, have been submitted to the Bureau, and these works should be in commission before the end of the year.

This means, that at the close of the present year, the sewage from all the cities and thirteen towns in the province, representing about one-third of the total

population, will be rendered practically harmless before being discharged into our watercourses. When it is considered that in 1912 there were only five sewage disposal plants in operation, capable of treating sewage from a population of 16,500, it must be evident that municipalities are co-operating with the Bureau of Health in the improvement of the condition of provincial waterways.

"Systematic supervision and inspection is made of the existing sewage disposal works by the engineering officials of the Bureau."

I think that is an important matter. After the plant has been installed, the Government exercises supervision and sees from time to time that it is working efficiently.

"and suggestions offered, which are calculated to give a higher standard of efficiency in each new installation. The Bureau of Health has, up to the present, concentrated its efforts in the prevention of stream pollution by municipalities, but now that the towns and villages are alive to the consequences of neglect in matters of sewage treatment, it is the intention of the officials to direct their energies towards the large section of the population who, individually rather than collectively, contaminate surface water supplies. There are numerous settlements, camps and villages along our streams and creeks, which have no system of disposing of their sewage, but simply use the nearest watercourse as a common sewer. Such streams being subjected to direct pollution from faecal matter entering the water from isolated houses or camps, are capable of carrying disease through the large areas of the province which they traverse. This form of contamination is particularly dangerous, and is largely responsible for the outbreaks of typhoid which have occurred in the province. The possibility of some such direct pollution being present in a river, which is supplying unfiltered water to one of our larger towns, is only one instance of the vigilant guard, which must be kept over our streams. With this in view, the Bureau of Health is about to commence a thorough and exhaustive inspection of the various watercourses throughout the province."

Q. Would you just explain to us the method of sewage treatment. That report does not seem to make very clear what system they are pursuing?—A. No. It does not, but I believe they have some form of sprinkling filters in which the sewage is distributed.

Q. How do they keep them from freezing?—A. I believe some of these places are covered in. It is quite possible to cover in a small plant. I have here a plan, drawn up by the late Mr. Galt, for the town of Palmerston, Ont., to help them out of the difficulty caused by the pollution of a branch of the Maitland River, which comes out at Goderich. Palmerston has a population of two thousand. The sewage comes in here (indicating), where the grosser materials are removed. It then passes on to the septic tanks. That, you see, is the sludge basin into which the sludge drops. From there it is run to the sprinkling filters, which are built up for five or six feet, with either gravel, stone or other material, and the revolving arms distribute the sewage on to these beds. Then it passes into the next tank, where you can add your hypo; or any other preparation you like. It then goes out to the river. This is an up-to-date plant. The total cost, including an extension of the trunk sewer and fifteen per cent for contingencies, was estimated by Mr. Galt at \$15,068. If you will permit me I will hand in a statement showing the cost of this plant and also one at Bridgeburg and at Preston. (See exhibit No. 7 in Appendix.)

*By the Chairman:*

Q. What is the population of Palmerston?—A. Two thousand.

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*By Mr. Steele:*

Q. What is the date of that report?—A. 1909. It was prepared by the Board of Health for the town of Palmerston.

*By the Chairman:*

Q. Was that plant installed?—A. I am not certain, but the plant is on up-to-date lines and the estimate, compared with other cities in the United States and Great Britain, is a pretty fair one.

Mr. STEELE.—You would have to add fifteen to twenty per cent to that figure now.

*By the Chairman:*

Q. What is your experience of the rivers in Canada?—A. In regard to pollution?

Q. As regards pollution.—A. Beginning with the tributary rivers: for instance, take the river Thames in Western Ontario. You have a large number of growing towns there and two cities depositing their sewage virtually untreated into this river. They are polluting to-day the whole river, and no doubt it is becoming sludged up at points where it is not flowing rapidly. The still waters are sludged up and they become a nuisance and a menace to the farmers of the country through which the river flows.

*By Mr. Steele:*

Q. Just explain in what way they become a nuisance to the farmers?—A. The grosser material sludges up the river at points; it ferments and pollutes the stream so that the cattle cannot use it. The streams are the natural watering places for the cattle, and they are even the source from which the farmer gets some of his water supply. The farmers have to be protected, and it is manifestly unfair that a large town should be pouring its sewage into the river with no treatment at all and putting upon the farmers, or anybody, a nuisance.

*By the Chairman:*

Q. You spoke of a small river becoming sludged up. I suppose the sludge is accumulating month after month and year after year, and that it is lying there. Is there any danger from that sludge? Does it contain disease germs?—A. No, not after a time. The disease germs die out. They have a life history and die out. Perhaps they may lie there dormant, but they may be awakened when fresh food comes in. But, certainly, those rivers are fruitful fields, so to speak, for disease organisms to grow in. Supposing somebody pollutes them from a house—a farmer builds a good house and runs his sewage into the creek; and a typhoid fever carrier comes along; that sewage polluted creek is a good place for the propagation of the germs. There are places in Ontario where a farmer when he took the land had a splendid creek, and the town has polluted that creek until it has become a stinkhole. I know of cases where a farmer had to fence off his stream because his cattle could not drink the water.

*By Mr. Warnock:*

Q. In the case of a freshet the spores may grow?—A. I was coming to that; I was taking up the small rivers and leading up to the larger ones. In the spring the whole thing is washed further on down, and you spread the pollution. You have then practically a long-drawn-out sewer. That is the only thing, Mr. Chairman, you can liken to it. In the case of a town it is covered over, it is constructed sewer; but as soon as it gets into the creek it is an open sewer, and liable at all times to fresh accretions and fresh pollution. Then, when you come down to our lakes, at the

spring of the year all this stuff must be carried away and it is carried into our lakes. And certainly we have not realized yet the great expense of dredging our harbours from sewage—not washed in as silt from the land, but as sewage from our cities. There are towns in Ontario which simply dump even their dry garbage into a creek, and when you ask them why, they say: Oh, well, the next rain-storm will wash it all down. That is what happens over the length and breadth of the land.

*By the Chairman:*

Q. Does the Ontario Health Law not provide a penalty for that practice?—A. It does now, because the Central Board of Health has the power. Previous to last session it only had advisory powers; it could only say: you had better do this or that. It was necessary to proceed against a municipality under the Criminal Code then to get results. But now with the central power exercised by the Provincial Board, they can go in and do at the expense of the municipality whatever is ordered, if the municipality fails to carry out the work after being notified. I would like to point out, Mr. Chairman, that this report from Saskatchewan to me emphasizes the fact of the willingness on the part of the provincial authorities to prevent pollution of waterways. That young Province shows how it handles the situation, and how much easier it would be to have some uniform system if the Federal Government would adopt such a Bill as that proposed. It would make it so much easier for the Federal Government to co-operate with the Provincial authorities who are doing such good work already.

Q. You have seen the two Bills that have come to us from the House of Commons. Do you consider that the Bill I introduced would be effective if put in force?—A. Yes, with, proper regulations, and a proper person to administer it. You want a proper department as well. The Bill would be of no use without that.

Q. Give the Committee your idea of what a proper department would mean. Does it mean a department composed of medical men, or of highly trained sanitary engineers, or something else?—A. In my opinion I quite agree with Mr. Kennedy that two or three heads are better than one. It is not a case alone for the sanitarian, that is the medical man who is trained in sanitary science. It is not alone a question for an officer of that kind; but it is one for the sanitary engineer. Both have their duties to perform; but it is primarily a health matter and it must be dealt with from the health standpoint. But you must have the different branches of the unit. You want your chief executive officer; you want your sanitary engineering officers, men who will go over the country and view these different plants, make their reports upon them and supervise their operation. That is an engineering matter. And then, not in opposition to but in co-ordination with the health men, the chief executive could judge of the results as to how plants are working. I am rather loathe to use the word 'medical man,' because this whole question is broader than simply medicine; it is broader than sanitary engineer. You want both sanitary engineers and sanitarians.

Q. Would you consider that the training of the average medical man fits him for the work of sanitation, for taking care of the health of the country?—A. No, sir, it does not. Sanitation is a separate branch. Personally, I would be loath to go in as a surgeon and operate. That has not been my special branch. Twenty years of sanitation has been my special branch. And it is just the same in regard to engineering. You have the railroad engineer, the sanitary engineer and the electric engineer. What we want is a sanitary engineer.

Q. I asked Mr. Kennedy and Mr. Lea the other day regarding the training of sanitary engineers. Would that not apply to bacteriologists, would they not have to be specially trained?—A. Specially trained in public health work.

Q. Have you any information as to what would be necessary to obtain a thoroughly trained, efficient department of health, with sanitary engineers attached?

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Have we the men today in Canada trained for that purpose?—A. You would have the framework for it in a department such as I have outlined.

*By Mr. Steele:*

Q. But not the organization.—A. You have to have the proper organization. You have certainly men to do the work. You have bacteriologists and chemists. You have men who have graduated in sanitary science. McGill University has graduated a large number in sanitary science. The McGill degree in sanitary science is accepted in Great Britain, and in the British army and navy, so high is their standard. They are doing the work at McGill today under a qualified professor.

*By the Chairman:*

Q. Would it be a good idea for the Government to encourage the training of both sanitary engineers and men to look after the public health?—A. If you create just such a department as you have in your mind, so that there are positions for men to fill in engineering, in chemistry, in bacteriology, and sanitation along medical lines, then you create an opening at once for the young men of Canada to take advantage of. I know several men who have their D.P.H. degree, who are today practising medicine, because there are no positions to fill in Canada unless they resort to wire-pulling with city councils to get in. I know several qualified men who have served their time, not in Canada but in England. It is just the same as in other branches. In veterinary science to-day the Dominion Government have a staff developed that a few years ago was never thought of. Once you create a department you will have the members of the profession qualifying as specialists.

Q. This would emphasize the necessity of a Bill such as is before the Committee now?—A. It is a strong argument in favour of it. It would be a bonusing of the universities, and young men would graduate for the service. No man is going to spend twelve months after he graduates to complete his education in sanitary science unless he sees there are openings for him.

*By Mr. Warnock:*

Q. You must create a demand for his services.—A. There is a necessity in my mind for the Federal Government to establish a department to deal with questions of this kind, the pollution of waters, or any of the other questions of sanitary engineering and public health.

Q. Is there not a Department of Public Health at the present time?—A. There is the Director General of Public Health, who is under the Minister of Agriculture. He administers the Quarantine Act, the Act relating to Leprosy, and the Public Works Health Act, under which the health of men in construction camps, on works receiving government aid, such as the building of railways, and so on, is supervised. Those are all the functions of that officer to-day.

Q. I might ask you, doctor, last summer I think it was, three medical men were summoned to Ottawa in connection with something of that kind, Dr. Kennedy of McLeod, a doctor from Winnipeg, and a doctor from somewhere east of Winnipeg. They were appointed by the Government to some special Board of Health?—A. That was probably in the case of some particular outbreak; the Department has the power to appoint officers; supposing smallpox broke out south of the International Boundary line, as it did some years ago in Minnesota and all through that district, the Minister could appoint medical men, as he did then, to supervise the quarantine. They may call these medical men out at different times to act under the Director General of Public Health, who has officers under him at his quarantine station for the purpose of carrying on the quarantine work, but there is no Federal Department of Health.



*By the Chairman:*

Q. To make this Bill effective it will be absolutely necessary to have a Health Board under Government authority?—A. It would not mean necessarily a Health Board, it would mean a Department of the Government. In addition to that the Government could have power if they wanted it, to call at any time an advisory Board. What I mean by that is that the members of that Board would not be constantly employed, but at any time when he considered it necessary the Minister might call a Board of Sanitary Experts. That would be a wise provision.

Q. That is in addition to the Department?—A. In addition to the Department.

Q. Your idea would be, if I understand you aright, to have a Government Health Department headed by a Minister or a Deputy?—A. Not necessarily another Minister, it might be under one of the present Ministers of the Crown; so long as you had at the head of that Department a Deputy who was an expert it would not be necessary to increase the portfolios to make a Department and to co-ordinate the many health duties that are performed to-day in different Departments, because there is health work carried on in other branches of the Government, than that now under the Director General of Public Health.

Q. Have you any idea what staff they have in connection with the Health Board of Saskatchewan?—A. The health work in Saskatchewan is carried on by the one officer, there is no Board of Health in Saskatchewan, Dr. Seymour is the Chief Health Officer of the province and works directly under the Minister. Then in addition to that there is a consulting sanitary engineer, T. Aird Murray, and a resident engineer, Mr. Murray, whose report I have read to-day; then he has medical inspectors as they are required for the province, and in addition to that he has the Vital Statistics Branch in which there is a chief clerk and there are sanitary inspectors and other officers.

Q. Have you anything else, doctor, you want to put on record?—A. You asked, Mr. Chairman, about the Ottawa typhoid outbreak?

Q. Yes, will you give us information about that?—A. Yes. This (producing document) is my report of the Ottawa outbreak; I made two investigations, one of the first outbreak and the second of the last outbreak. The report of the first investigation you have printed there. It is a rather extraordinary thing that we should have two outbreaks of typhoid fever, the one a summer and the other a winter outbreak, occurring within such a short period, but both outbreaks were due to specific infection of the water supply between the intake and the pumphouse.

Q. Between the intake and the pumphouse?—A. Yes.

Q. Then you do not attribute the outbreak to the water taken into the intake itself?—A. No, no, because there was very little water coming into it; the intake pipe leaked so badly that there was really no water coming in at the mouth most of the time, the greater part of the supply being taken from close to the shore and being contaminated by the specific infection.

Q. If that intake pipe had been perfect all the way through is it your opinion there would have been no outbreak?—A. There would have been less chance for an outbreak, but I would not say there would have been none.

Q. The water at the intake was a good deal better than that which came into the pumphouse?—A. That is quite clear. (Produces map.) The pollution may have taken place here (indicating). There was a sewer all along here discharging just over the clear water pipe, and the clear waterpipe leaked as you see in this photograph. It also was possible for pollution to get in at different points, it got in, possibly, at the pumphouse itself.

*By Mr. Steele:*

Q. Have not similar outbreaks occurred in other cities throughout Canada?—A. Yes, in a lesser degree, certainly. (Produces chart.) Now, this chart shows you,  
Dr. CHARLES A. HODGETTS.

Mr. Chairman, the dates of the pollution at Ottawa, and two weeks afterwards the red lines show the number of cases; it is quite apparent how one follows the other two weeks after the maximum infection you get the maximum number of cases. It was so in the other outbreak. Then, again, typhoid always affects those in the most active period of life. You see from this chart that the young men, people from 25 to 40 years of age, were the ones who were stricken down, and in all about a hundred cases were carried away. This (indicating on diagram) shows how that clear water pipe was broken at the bottom, it is quite plain, and that shows you how the water could have become polluted. Virtually, Sir, these things are great object lessons, pointing out that if there had been a proper Federal Department with supervision of the water supply, a great many of these cases would have been avoided; there would be supervision of construction as well as of operation.

Q. Have you any data to show the number of typhoid cases in the city of Ottawa during those two epidemics?—A. Yes, sir, they are in these two reports here.

Q. We would like to have that information in this evidence.—A. I have here the total mortality from 1901 to 1910 in the city of Ottawa.

Q. We just want the statistics for the two epidemics. If I remember aright there were about 2,500 cases?—A. The total number of cases in the first outbreak we were able to investigate from January 1 to March 1, 1911, 901 cases; there were many cases that were not reported, as I pointed out before, and we were not able to get them, but that included 901 cases at that time. Then from that time on it is interesting to note that typhoid was not absent from the city of Ottawa, and we have following on in March, 1911, after the report, there were six deaths, in April 12, in May 2, and so on right on down to the second outbreak; it was virtually not absent from the city right straight through until the next epidemic. The strong point is that there was pollution going on all the time and deaths. Now, in the second outbreak we investigated 794 cases, these were all bona fide cases.

Q. Now, while there were only 160 or 170 deaths is it not a fact that in a great many of the other cases, some 2,500, while the patients did not die the disease left them with a weakened constitution and impaired health?—A. You cannot estimate the loss to the individual in physical vitality or what damage does occur from typhoid fever, but anyone who has watched a series of cases of typhoid fever will recognize the fact that taking place as it does in such a critical time in a person's life it does affect people very materially, there is no possibility of doubt that, they are scarred just the same as they would be from a wound, but it is something you cannot estimate, although it is quite evident that it does affect them.

Q. Is it a fact, I have seen the statement made and of course you being a medical man know better than I do, that typhoid patients, while they may escape death, are left with weakened constitutions, and they are more susceptible, in fact, very susceptible, to tuberculosis?—A. Well, you lower the vitality, and any other disease might follow on. For instance, in typhoid fever the muscular tissue is weakened very much, the heart muscles and all, and you may have a weakened circulatory system. At the same time, if a person has been infected with tuberculosis it may progress rapidly after typhoid.

Q. But if the attack is not fatal does it not leave the system in a condition more susceptible to other disease?—A. There is a lowered vitality also, you may just sum it up as lowered vitality.

Q. That means that the body is more susceptible to all disease?—A. Yes, and they are not in as good physical condition as they would be if they had'nt had typhoid, there is no doubt about that.

Q. Do you, as a medical man, look on typhoid fever, as a serious menace to the health of the citizens of Canada for future generations? What I mean is this, that after an outbreak like this is it not possible that the children that are born from parents who have suffered from an attack of typhoid will not have the same strength

and vitality?—A. Yes, Sir, that is a problem in eugenics. I believe that when anything lowers the vitality of the parents there must be some effect on the offspring; what it is we do not know. But there is this danger that out of all the cases of typhoid fever you will have a certain number of those who become carriers of the disease, and while they may have had typhoid in a town or city they scatter it to different parts of the continent, and they may carry typhoid germs all the rest of their lives, that is one way the disease is scattered.

Q. They never recover from that condition?—A. They may always be carriers, and they are a menace to whatever place they may go; there is not the slightest doubt that is one way in which typhoid has been carried from the town to the country. The patients who recover from typhoid generally seek recuperation in the sunshine and free air of the country and they go to the farm for that purpose and that is how it is carried, they are still carriers.

*By Mr. Warnock:*

Q. Haven't there been cases where although the farmer and his family have never suffered from typhoid themselves their visitors have been taken down with the disease?—A. You mean that a nurse carried the disease?

Q. No, they carried the typhoid bacillus in their systems, I think there are such cases on record.—A. There may be.

Q. The persons may be immune themselves but are carrying the bacillus in their systems?—A. I have not read anything along that line of collective work. Certainly the carrier is a menace today, a great menace, and every new outbreak adds to the number.

*By the Chairman:*

Q. If we create a Federal Board of Health, with a staff of proper sanitary engineers, would it be possible, in your opinion, to reduce typhoid fever to any great extent in Canada?—A. Yes, you would materially reduce the typhoid just the same as it has been reduced in European countries. There is no reason why typhoid should not be brought down the same as it has in Germany and England. (*See Tables of death rates from typhoid in European countries, page 61.*)

Q. Is there any reason why we should not be able to bring down the death rate from typhoid to a lower point than in Germany and other European countries on account of our having such great rivers and such sparsely settled districts?—A. I quite agree with you. It was simply saying the rate could be brought down to what it is in Great Britain, and even reduced to the low figures in Scotland.

Q. Which is 6.2 per 100,000?—A. Yes.

Q. To what percentage do you think we could reduce the death rate from typhoid if we had a properly constituted Board.—A. I would expect to find it down to somewhere near the British rate of 11 or 12 per hundred thousand.

*By Mr. Steele:*

Q. The conditions which produce typhoid are perfectly controllable?—A. Yes. The people should be forced to take proper steps in regard to the disposal of their sewage and the care of their water supply. The policy adopted in that regard would be an indicator as to the vigilance of your Federal Department of Health.

*By the Chairman:*

Q. You believe it is possible to stamp out typhoid as an epidemic and place it in the same category as ordinary diseases?—A. I believe it is possible to minimize it by working along the lines indicated. I believe that it would pay the country much better to do that than to spend money along many other lines.

Dr. CHARLES A. HODGETTS.



*By Mr. Warnock:*

Q. All cases of typhoid are not caused from the drinking of water. I have known cases that were traced directly to inhaling sewer gas carrying, of course, the typhoid bacillus?—A. In the main, typhoid is due to polluted water supply. Sometimes it is due to pollution of milk and of food. The latter is generally raw food such as lettuce, celery and things of that kind. You may also have it from eating contaminated ice-cream. These, however, are all minor outbreaks. Then you have, at every outbreak of typhoid fever, what we call secondary cases that are due to infection either from a patient or from a nurse. We had such cases in Ottawa. We had as many as three cases from the original first cases. But in the main, it is a water-borne disease. When the disease originates from the milk it is not owing to the cow itself but to the water that is put into the milk or is used in washing the vessels.

Q. The milk may be contaminated?—A. Yes, from a carrier, or water.

Q. And from sewer gases?—A. From a carrier or water usually.

*By the Chairman:*

Q. I want to clear up that point. Doctor Warnock makes the statement that typhoid fever can be contracted by inhaling sewer gas. Is that possible?—A. There are some specific diseases that may be carried possibly by sewer gas coming up through the sewage system into the house.

Q. Would that produce typhoid? A. Personally I have never traced any cases to that cause. There are cases of typhoid just as there are cases of diphtheria, which are said to have arisen in that way.

*By Mr. Warnock:*

Q. It is a very common thing in some parts of Canada?—A. Our American friends have attributed the spread of typhoid a great deal to the flies.

*By the Chairman:*

Q. I want to determine more accurately what the danger is from inhaling sewer gas?—A. I think that some years ago one of the Medical Officers under the Local Government Board or State Department of Health reported some cases of typhoid as being due possibly to the inhalation of sewer gas, but that is the most I can say about the subject.

*By Mr. Warnock:*

Q. There was an outbreak of typhoid fever in the Mounted Police Barracks at Regina a few years ago, and that was directly traced to a leaking sewer pipe near the kitchen.—A. Of course flies may have carried the disease.

Q. You may contract the disease just in the same way that you may contract tuberculosis.—A. Nobody wants a leaking sewer pipe, or sewer gas, in the house, it lowers a person's vitality, even if it does not actually give him the disease.

Q. Would you not say that the bacillus may be inhaled from the atmosphere just the same as in the case of tuberculosis?—A. The latest experiments in England in regard to diphtheria indicate that these small germs may be carried in the air, but speaking of typhoid in Canada, I know of no cases that may be attributed to the inhalation of sewer gas.

*By the Chairman:*

Q. If the theory be correct that typhoid fever can be contracted by inhalation would that not prove conclusively that the stench arising from sludge deposited by the sewers on the shore when the water recedes would be a menace to the lives of the

people?—A. In answer to that I might say that there appears to be no danger to the health of men that work all around the sludge on sewage plants. Like the men who take out night soil in cities they are generally pretty robust fellows. I do not know of any case where these men have developed typhoid fever.

*By Mr. Warnock:*

Q. In the case that you speak of the sludge would be exposed to the sun's rays. In the case of gas coming from the sewer pipe there is no inhibition, as it is called, of the bacillus from exposure to the rays of the sun?—A. I do not think there is any danger from sludge or material of that kind. In the city of Birmingham villa residences are being built on the highland surrounding the place where the sewage disposal plant is located.

Q. Has not the sludge been treated?—A. It is deposited in open tanks. There is certainly a little heavy odour at times, but nothing very much.

Might I just refer to two further points. One is in reference to New York harbour. I believe that at the first meeting of your Committee, some questions were asked by Mr. Hazen in reference to tidal waters.

The CHAIRMAN.—That is correct.

The WITNESS.—The city of New York is to-day up against the question of the pollution of its harbour by sewage, and this (exhibiting volume) is the report of their commission on the matter. This commission virtually recommends that disposal plants are necessary for the various municipalities that are within the boundaries of Greater New York for the keeping clean of the harbour by the removal of the grosser materials. That is the finding of this commission as reported to the New York State Legislature.

Then in England, I have made inquiries as to the effect of sewage contamination on oysters, even a small municipality may pollute an oyster bed with sewage. Therefore, for the sake of preserving that great industry uncontaminated, our Canadian seaport municipalities should be required to treat their sewage before discharging it into the sea, or into the bays and mouths of rivers. The city of Baltimore serves as an example. That city has had to treat its sewage up to the finest point, and even to sterilize it before the effluent is run off into tidal water, on account of their having to protect the oyster beds. At Baltimore they treat the sewage in the final tank with hypochlorite before it is run off and dropped some fifteen or twenty feet into the ocean.

*By the Chairman:*

Q. How would the sewage going into the sea on the Atlantic coast from Halifax, St. John and other seaports affect our oyster beds?—A. That becomes a local matter. At Baltimore, on account of their oyster beds, the sewage had to be treated. The sewage seems to be carried backwards and forwards with the ebb and flow of the tide, and it remains in certain localities. In Great Britain, where the question has been considered, it is the feeling that municipalities should be required to treat their effluent before even it is thrown into tidal waters, and even where the sewage is a comparatively small amount, where the discharges are near oyster beds.

Q. Have you any data at all regarding the disposal of sewage which empties into the harbour at Victoria B.C.?—A. No. I have only the reports of their health officers and they do not contain any information with respect to the disposal of sewage there.

There is another matter I wish to bring forward if I may detain you for a moment or two longer. Health authorities in the United States and Canada do not agree upon the question of pollution of waterways and the providing of pure water supplies for our people.

In the main sanitary engineers and some sanitarians in the United States are  
Dr. CHARLES A. HODGETTS.

satisfied with the depositing of raw sewage into any body of water and then protect the public by requiring filtration of the water and they go so far as to recommend the additional precaution to provide for disinfection after filtration.

Prof. Whipple, of Harvard University, recently stated in reference to the best method of protecting lake water supplies: 'The best method is to filter water. This is more efficient than disinfection of the water and much cheaper than purification of the sewage.'

Dr. Allan J. McLaughlin, of the Public Health Services of the United States, in a report on Sewage Pollution of Interstate and International Waters, 1912, in general summary states, in part (p. 293):—

'There is an undue prevalence of typhoid fever in many cities and towns in the drainage basin of the Great Lakes.

'This excessive prevalence of typhoid fever, especially in the winter and spring months, is due in greatest measure to sewage pollution of interstate and international waters used as a source of public water supplies.' \* \* \* \*

The undue prevalence of typhoid fever is an interstate menace and is responsible for the spread of the disease from one state to another, when such undue prevalence is manifest in (1) cities of commercial or industrial importance, (2) tourists' resorts which attract visitors by their natural or artificial advantages, (3) summer resorts.

The drainage basin of the Great Lakes contains many cities and commodities in each of the three classes. Not only is typhoid infection distributed by these polluted water supplies to the thousands of visitors from other states, but railroad trains and vessels take their food and drink supplies from these infected centres and distribute supplies en route to their interstate passengers.

In the introductory portion of his excellent report on 'Sewage Pollution,' Dr. McLaughlin states that (p. 41):—

'Disposal of sewage by dilution is the cheapest known means, and where this method can be employed without detriment to the water supplies or danger to the health of other communities the exaction of more complicated and expensive methods is scarcely justifiable.'

This reference, I take it, is to the subject under report, viz.: the 'pollution of the Great Lakes.'

Apparently after a careful study of the question he recommends:

'Dilution as a means of sewage disposal should be permitted for economic reasons wherever possible without detriment to the public health up to the point where the sewage contributed does not put an undue strain or an unreasonable responsibility upon filter plants by making the bacterial count and the colon content of the raw water too high for safety.'

In short continue to pollute and then depend on safety to life and health by general filtration notwithstanding the fact that he states (p. 293) 'Some filter plants have serious structural defects. Others are structurally satisfactory but improperly or carelessly operated.'

Regarding this, officers of the United States government, I desire to direct your attention to the evidence of Hon. James A. Tawney, Chairman of the International Joint Commission, given before the Committee of Foreign Affairs, House of Representatives, Washington, D.C., February 24, 1913, as follows:

Mr. TAWNEY.—The Canadian section of the commission has not named anybody as yet, but Dr. McLaughlin has been employed by the commission to have charge of the field work on both sides. Because of his experience and knowledge of the subject the commission has given to him the authority to supervise and control the field work on both sides of the line. They have in contemplation the expenditure of the same amount of money on the other side in the employment of, possibly, three sanitary experts for consultation purposes, but Dr. McLaughlin, by the unanimous action of



the full commission, has been given full authority over all the field work on both sides of the line.

I make this quotation as showing the opinions of one who according to the Chairman's statement has charge of the field work in Canada as well as in the States and, as the only sanitary expert of the commission or the chief one at least, will have considerable weight with the commission when they come to the point of arriving at any conclusions as between proper disposal of sewage before deposition into the lakes and the partial protection to be found in the filtration of public water supplies from lakes which are daily becoming more and more polluted by reason of the increasing volumes of sewage and trade waste poured therein.

The CHAIRMAN.—It seems strange we should employ a man with a theory of that kind conflicting as it does with our own theory.

The WITNESS.—Well, that is the sworn statement made by the Chairman. I thought it would interest this Committee to know that this question is going to be reported on by a man who is going to supervise the work for both sides of the line.

*By Mr. Steele:*

Q. What reason does he give for opposing the Canadian methods?—A. Briefly, his objection is that our method is too expensive. It is beyond the pockets of municipalities to treat their sewage. I am not quarrelling with him upon that point but the Provinces of Saskatchewan, Ontario and others—and I think the public generally are behind us—have declared that it is in our own interest to stop the pollution of our waterways.

Q. He does not pretend to say that pollution is not occurring?—A. Oh no, this book is full of it.

Q. It is just a matter of dollars and cents?—A. Yes, but it is a serious matter for Canada. He looks at it from the point of view of domestic water supply.

*By Mr. Warnock:*

Q. He does not think of our streams being converted into sewers or its harmful effect in the watering of stock, preservation of fish, etc.?—A. No, nor does he consider the ten million people travelling on our lakes every summer, without the protection of the water supply used by the vessels thereon. That is a matter only the Federal Government can deal with.

The CHAIRMAN.—It is an international question.

The WITNESS.—The Federal Government alone can deal with it. It constitutes another argument in favour of the Federal Government taking charge of this question. Perhaps I may be allowed to read a short statement I have here, before closing.

‘Of course, it cannot be expected that were every town and city to treat their sewage effluent so as to render it non-putrescible and non-pathogenetic there would be assured to all consumers of lake and river water, supplies that would be guaranteed pure. It can be stated, however, that with the removal of all gross material from sewage and its subsequent partial purification and sterilization, the much vaunted, grossly abused, so-called ‘natural purification’ by the dilution method’ will give infinitely better results. At present, the claim that an all-wise Providence will do all the work thrust upon Him by engineers and municipal authorities, and, alas, by some sanitarians, is a blasphemy as great as civilized (?) man ever perpetrated. For it is safe to say that this failure of the dilution method is clearly demonstrated in the sixty million dollar experiment of the Chicago Drainage Commission, which has, to be sure, succeeded in developing power but certainly has miserably failed in demonstrating that even by using as much water as flows over the American Falls at Niagara, their sewage and factory waste has been disposed of either efficiently or in a sanitary manner. There is no question that the system

adopted has minimized the danger of the pollution of the city water supply, but, it cannot be said that it has solved the more difficult one: of how to dispose of the sewage and factory waste of that city.

Where international waterways are concerned, the problem is a complex one. The chief offenders are naturally the more numerous towns and cities to the south of the boundary line, although it is simply a difference in degree as regards the quantity of pollution, nothing more; for the citizens of both Canada and the United States are guilty. We, in Canada, however, have taken the stand that municipalities must provide for the treatment of their sewage, thereby lessening the contamination of our pure water lakes and rivers. Health authorities in Canada are unanimous on the question of the prevention of pollution, not only because they hope to secure for municipal authorities pure water reservoirs from which they may obtain potable waters, but because they believe that municipalities in their own interests should not continue to make these reservoirs the receptacles for raw and untreated sewage thus wantonly making them the sources of disease and death to many thousands who either innocently or compulsorily use the same.

It is a cardinal principle to be observed by all citizens that sewage should be properly and scientifically treated and disposed of; that no one should discharge into any body of water which may be the source of water supply to a community a sewage effluent that is not non-putrescible and non-pathogenic. I believe that this is sound in principle and possible in practice. Further, I believe that, unless municipalities will secure their water supplies from carefully protected upland sources, it will be necessary in most instances to filter the water.

As regards the disposal of sewage by lake and river steamers, the most stringent rules should be adopted and rigidly enforced by the proper authorities to prevent the indiscriminate pollution of navigable (fresh) waters. At the same time, the water supply for all vessels as well as railroads should be taken only from known sources that are certified to be pure.

The only way the international waters can be safeguarded and the public protected, is by a co-ordinated movement of our Federal and State or Provincial authorities.'

Committee adjourned.

FRIDAY, May 30, 1913.

The Committee met at 10.30 a.m., the Chairman, Mr. Bradbury, presiding.

Dr. P. H. BRYCE, sworn.

*By the Chairman:*

Q. Your name in full, Dr. Bryce?—A. Peter Henderson Bryce.

Q. You have been engaged in sanitary work for a number of years?—A. For many years.

Q. Would you give the Committee an idea of your experience?—A. In 1882 I was asked by the Government of Ontario to become Secretary of the Board of Health which was that year organized, and for twenty-two years afterwards I was executive medical officer of Ontario, and during that time, as regards this work, under the Act of 1884, which was a public health Act, all the sewage disposal propositions that came up in any part of the Province had to be overlooked by the Board, and I, as executive officer, did the work, and the work of determining the methods of sewage

disposal was of course intimately associated with the local work of the local water supply, and in that time I think I was responsible for the oversight of probably a hundred public water supplies and some 40 or 50 sewage disposal works. Since that time, of course, I have been in Ottawa in the Immigration Service.

Q. I suppose you have seen the Bills now before the House of Commons and the Senate?—A. Yes.

Q. What is your opinion, with your vast experience, regarding the advisability of Parliament taking action in stopping the pollution of our lakes and streams?—A. In general terms, I would say that there is no question as to the desirability of there being legislation providing for the definite control of sewage disposal. As to what that sewage disposal would mean however, in my judgment I would say that I am sure no rules could be laid down under the Bill for dealing with the sewage disposal of all towns on a common basis. The dilution, for instance, in the Ottawa river as compared with the creek at Berlin is so absolutely different that you have at once two problems, which an intelligent sewage board, or Rivers Conservancy Board as they call it in England, ought to be in charge of, to come to an intelligent determination as to what ought to be done.

Q. What is your opinion about sewage treatment? Do you believe that sewage, before it is allowed to escape into a waterway, should be purified?—A. I think it is generally considered now that the term 'purifying of sewage' must be distinguished from the term 'treatment of sewage.' I have said that I believe it necessary to have the law. With regard to what the treatment means in any given case, I think it would be well to illustrate what I believe to be the situation. We all know the city of Ottawa, as an average city, is pumping about 200 gallons of water per head per day, or about four times as much water, and more than four times as much water, as the town of Berlin, which has to take its water from artesian wells, requires for a town many times busier as a manufacturing town than Ottawa. If you attempt to deal with the sewage of Ottawa at the rate of 200 gallons per head per day, you will require the installation of works so expensive owing to that one item of four times the amount of water in the sewage that you are introducing what would mean a financial problem that the city of Ottawa cannot practically cope with at all. Mr. Race, the bacteriologist, the other day, said that on this continent his figures gathered up here and there show that the cost of sewage treatment per million gallons runs from \$11 to \$15. Now, we are pumping roughly 20,000,000 gallons in Ottawa today, every day, so twenty times 12, we will say or twenty times 15, means over \$200 a day for the handling of the sewage after you have established your works, or it means \$1,000,000 annual output for the handling of the Ottawa sewage when the amount of water is what it is. In the town of Berlin, some twenty odd years ago, after our Board approved of the system, they installed what they called filter beds where the outlet pipe from the town could readily flow on to them. That was a very strong clay soil, and did not filter the sewage enough. They polluted the creek so badly that there was a lawsuit and they finally, after a fine of \$20,000, bought land on the hillsides which was sandy soil, and put in a septic tank at the end of their pipe on the level, and they lifted the liquid to this filter bed on the sand, which gave a perfect filtration. The original cost was considerable, but a perfect result was obtained, because the water there is 45 gallons per head per day. So I say after you reach the question of what you are going to do then you have to discriminate in each particular case.

*By Mr. Northrup:*

Q. Is there any way of limiting the pollution of streams?—A. The very primary question that you are going to deal with in that Bill absolutely demands that the Bill will include a power by which the law will control the amount of water pumped, because I have never known a municipality, except Berlin and possibly one or two others in this country, that has had enough common sense municipally to simply say:



We will put meters on every body's waterpipe and make him pay for his excessive water. It costs about \$13 or \$14 to meter a house, and they have never been able to do it, the reason being that Mrs. So-and-So, who has had plumbing, will not send for the plumber, the plumber being a very expensive article as we all know, and I know in this city of water running out of an inch-pipe in a warehouse, discharging possibly, twenty, thirty or forty thousand gallons of water through a single fixture for which a man is paying \$10 a year. If you are going to deal with this question, you must deal with the question of water-supply and control.

*By the Chairman:*

Q. If it is the case, and I know it is, that there is bad plumbing, defective cocks, and that sort of thing, would you not think that the city of Ottawa would have its inspectors enforce the law? There is a law?—A. I have for many years preached the doctrine of municipal control of their own water supply. In Toronto it used to cost \$80,000 for coal when the town had a hundred thousand people in it. What it is costing now, I do not know. The town pays for the coal, and the ratepayer does not hear about the water that is wasted. And you cannot deal with sewage disposal until that question is settled.

Q. You were saying that there was about 45 gallons per head per day consumed in Berlin and about 200 gallons in Ottawa?—A. Yes.

Q. Would 45 or 50 gallons per head per day be sufficient in Ottawa?—A. The city of London uses at the most from 28 to 30 gallons per head for the whole population, and the death rate of that city is lower than the average death rate of Canada.

*By Mr. Chabot:*

Q. Is that rate applicable to any special disease, or is it general?—A. It is general.

Q. What is the typhoid death rate in London—five or six per hundred thousand?—A. There is not any in practice.

Q. What is it in Canada?—A. Thirty or forty per hundred thousand. Three times as much as the average English rate and yet we are using four times the amount of water.

*By Mr. Northrup:*

Q. You were speaking of the typhoid death rate being so high. What about enteric diseases?—A. The only other enteric that there is in temperate climates in practice is, for instance, diarrheal diseases. The deaths from children's diseases, which are practically diarrheal diseases, in some cities of this country, eliminating all extraordinary cases are twice those of the city of London.

*By Mr. Chabot:*

Q. I believe that about 25,000 children die in Canada every year, under one year of age. Is that correct?—A. We have 8,000,000 people. That is eight thousand thousand and the death rate of children under one year is about fifteen per thousand.

Q. What proportion of that number would die from improper feeding, which would apply partly to milk and water?—A. Compared with breast-fed children, the death rate among those is about seven times.

Q. That is, half the number die from improper feeding?—A. I would not say it is due to the local supply; of course milk enters very prominently into that.

*By the Chairman:*

Q. Now the death rate of children is very large?—A. Enormous; 25 per cent of all the births in the city of Ottawa.

Q. Would you attribute that in any way to impure water?—A. In a very, very limited degree indeed. The pollution of milk vessels from other causes is common and the condition of the milk itself from fermentation owing to bacterial changes

that are not in the water. I do not think that water is the primary cause from the fact that infants do not drink much water. I do not find typhoid, at any rate, amongst infants.

*By Mr. Chabot:*

Q. In connection with the matter of enteric disease, particularly typhoid fever; take the city of Ottawa as an instance, what do you think of Ottawa river water in its natural state, and under normal conditions?—A. The question, Mr. Chairman, comes directly in connection with the water and sewage disposal problem, and the condition of the Ottawa river can only be related to the amount of sewage that is put into it. The Ottawa river water analyzed on different occasions within the last two or three years, from Aylmer and above Aylmer down to Besserer's Grove, has shown a remarkable freedom from bacteria of any kind, a very remarkable freedom. So remarkable is that freedom that in some twelve samples out of thirteen taken above Aylmer, the number of bacteria is lower, that is, the total number of bacteria is lower than 100 per cubic centimeter, or lower than the standard of purity set by Prof. Koch after purification by any artificial methods, as sand filter.

Q. That is practically pure water?—A. Practically pure water. For instance, compare it with the Thames. In Dr. Houston's report as Director of London Water Analysis, published during the last seven years, he tells us that the Thames raw water has an average of 5,000 to 7,000 bacteria per cubic centimeter; that they take this Thames water and turn it into a basin, where it stands still for a fortnight; the sedimentation in that basin takes out 80 to 90 per cent, as a rule, of these 5,000 to 7,000 bacteria, leaving on an average 400 to 600 bacteria per cubic centimeter. Then they put the water through slow sand filter beds, which means simply five feet of sand at the top running down to gravel below at the rate of 2 feet per hour for each square foot of bed surface. In other words, when they have bacteria at the rate of 400 per cubic centimeter, they filter just 2,000,000 gallons per acre of surface per day. That is their standard. They reduce that down to a condition not one particle better than some twelve samples out of thirteen of the Ottawa river in its raw state above Aylmer.

Q. That is the water supply the people of the city of London have to drink.—A. That is the water supplied to the people of London and it saves them absolutely from typhoid fever. Turning to the Ottawa river which the Doctor has asked about, and on the same line of argument we will say that if you take the water from above Aylmer and supply it to this city you are supplying the same assurance of safety that London has after it has filtered the Thames water. Now take the river after it has come past Aylmer, it receives the sewage of 2,000 people a day or about one-fiftieth the number in Ottawa, and you ask, what does that do? To make a comparison you will understand it this way: the amount of water in the Ottawa river, that passes a given line across the river, in a single second is 50,000 cubic feet.

Q. That is the whole way across the river?—A. The whole way across the river. In one minute the amount of water that passes that line is equivalent to the total amount of water that is pumped into the city of Ottawa, or the total amount of sewage to be disposed of in Ottawa every 24 hours.

Q. In one minute?—A. In one minute. Multiply it by six gallons to the cubic foot and you have 300,000 gallons in a second, sixty times 300,000 is 18,000,000, just, in round numbers, the whole amount of water that is pumped every day. So that in one minute the amount of dilution applied to Aylmer sewage is—if you take Aylmer sewage at 100 gallons per diem it is only a small town, we will say 100 gallons, and multiply that by 2,000, and that is 200,000 gallons divided into 24 hours you will see what the pollution from Aylmer sewage which I worked out somewhere because I was interested in it, is as but one drop, it is only a hundredth part of it; it is as 4,200,000 drops of water to one drop of sewage. Now then the question arises how

Dr. BRYCE.

much danger in practice comes from the situation as it is? Mind you I am not approving of it, not necessarily; but what is the practical danger? It is that you may get in four or five million gallons of water one drop that has a typhoid germ. Now then the question arises does that constitute, or has it constituted a practical danger? Not that it may not do so, I will not say that it may not, but does it, or has it ever? To-day we know that we have had three epidemics since the first one I investigated here in 1887 when that wooden pipe in the aqueduct here had strips torn off it, and the water from the aqueduct got into the pipe.

Q. It was the anchor ice did it, was it?—A. No, it was in the autumn when it occurred, the winter ice had gradually worn off the surface of the old oak staves in the pipe; that was the first epidemic, and I was sure it was a water epidemic because is spread to Sandy Hill and every part of the city. Next year when they closed the end of the pipe, they found they got as much water at the pumps as before it was closed, and they took it out and put in an iron pipe. Now then, what happened? The same water had been going from up above that intake to Hull for 25 or 30 years, there had never been an epidemic in that city and there was no evidence from the number of deaths in the town that there was such a thing as pollution, while in Ottawa we only had eleven, or fifteen deaths from typhoid in the city in a year, and some of those people came from rural places, outside towns, summer resorts and other places. In 1911, in January there was a sudden pollution, but we know the reason: a valve in the aqueduct was opened in order to get enough water for the fire in the Inland Revenue building and immediately there was gross pollution and you got an epidemic. Last summer it was exactly the same way, when in the dry weather everybody was putting more water on the lawns, and there was a great consumption of water in the city, the pressure outward on the pipe ceased, and the joints at the various piers probably began to suck, and admitted the water, the pipe being unable to stand the pressure when they put the pumps more rapidly at work in order to increase the supply. That was last July. Now then, eliminating that gross pollution, you have this great dilution of the sewage in daily operation and the record is that the people of the city of Hull have taken their water supply from the Ottawa river for 25 years and there is no evidence of pollution from the epidemic standpoint. This spring you all saw the excited condition of the people in Ottawa, because we were putting 100 pounds of hypochlorite into each million gallons of water. Hull was taking its water from the same river and was not putting any hypochlorite into it and yet their town did not have one case of typhoid, so far as I know during that period.

Q. Just a few?—A. Just a few, but they may have come from anywhere. Now then, the point is, can we depend upon that situation owing to the great dilution of the sewage in that large body of water? So far it is quite clear we can.

*By the Chairman:*

Q. Just excuse me breaking in there; if I understand your argument it is that the sewage put into the river at Aylmer practically does not injure the city of Ottawa?—A. I say it has not.

Q. Well now, if that be the case; how do you account for the epidemic at Hawkesbury last winter? Dr. McCullough, of Ontario, whom you know very well, blames that outbreak to sewage from the city of Ottawa, and that town is sixty miles away.—A. In reply I may say this that after 33 years observation of our own outbreak and of outbreaks in the United States and in England I know of no evidence to show that with anything like the dilution that has necessarily gone on in the Ottawa river, with the sedimentation that has gone on, and with the rapid destruction of the bacteria, bacillus coli and bacillus typhosus in a medium foreign to them, that is water, I have no evidence to show me at all that any epidemic that has occurred during that period has been caused by pollution reduced to the extent the evidence shows the Ottawa does.



*By Mr. Chabot:*

Q. Following up that question, a few moments ago you expressed the opinion that the Ottawa river water in its natural state is a pure, healthy, palatable water?—  
A. Absolutely.

Q. And I think you believe that the two last unfortunate epidemics we have had in Ottawa were due to the pollution of the water supply?—A. Locally.

Q. To the pollution of the source of water supply to this city?—A. Yes.

Q. Now, I would like to ask you this question, in a general way, what do you suggest can be done either by the municipality, or by the Provincial Board of Health, or even by the Federal government if it has the power, to prevent or to minimize the danger following contamination or pollution of the source of water supply either here or elsewhere? I mean of rivers and lakes where they are the source of water supply for municipalities?—A. While I have said what I have said with regard to dilution which has not produced as far as I know, any unfortunate results—

Q. In a general way, I mean?—A. Exactly; I have to say with regard to every epidemic that I know of, in every case it has been due to gross, local, immediate pollution by sewage.

*By the Chairman:*

Q. Water borne?—A. Water borne. Starting with Duluth, Milwaukee, Chicago, Cleveland, Sarnia last winter, Windsor, Toronto, Niagara Falls, Kingston, Ottawa, Montreal, every one of these places has had its epidemic which has been shown to be due to gross, local, immediate pollution.

Q. Now, doctor, just right there. If the different cities and municipalities that have been and are still emptying their sewage into the lakes and rivers had adopted a proper sewage disposal system, would those epidemics have occurred in those places?—A. I am very glad, Mr. Chairman, that you have asked the question, because it is just the point upon which all your work, I understand, depends—

*By Mr. Chabot:*

Q. I was going to go further in connection with what the Chairman has said, and my question is this: Do you not think that Ottawa and other cities, should, or could, adopt means to dispose of their sewage on the same lines in a careful and scientific manner?—A. I think both questions are the same, are they not?

The CHAIRMAN:—Yes.

The WITNESS:—Very well, the question is just in this shape, and we shall deal with it just as England has had to deal with it in her relatively little streams where she has got a population of several hundred to the square mile, as we know. She says to us in her illustration of this—and a Royal Commission has been sitting over there on this subject for nearly ten years—that if you dilute the sewage five hundred times, so far as their experience goes, that is adequate and no further purification is necessary—or treatment, rather, because that is not a purification) except that it advises that the rough matters in suspension by running slowly be allowed to settle and be taken out before the effluent is turned into the stream. Now that is the most they can do over there. We shall have to go further if we wish to really apply purification methods to local sewage. Take for instance the city of Toronto, which is a case in point. The city of Ottawa is not, because we are not supposed to pollute with our own sewage—although we have done so—our own water supply. We have been taking the water above and putting in sewage below the city. But if you are going to deal with Toronto, or any of the lake cases, the question arises: How can you purify the sewage to be of any real benefit in the matter of purifying the water supply. If I might, I shall just run over what the stages of purification would be. Sewage has in it in round numbers 150 parts of sewage matter in 100,000, or rather about 100 parts of that is organic matter and consists of boots and shoes, refuses from the

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streets, excreta and other kinds of contamination. In other words, there is one hundred parts in 100,000 to be dealt with. Now take Birmingham, which affords you one of the best existing types of practical sewage purification. There, the first thing they do is to run the sewage as slowly as possible when it gets to the outlet and decrease the flow so that the heavy stuff will settle down where they can remove it out frequently. They run it at the rate of about one cubic foot per minute. That will precipitate or allow about fifty per cent of the heavy stuff in the sewage to settle down. The liquid is then turned into a series of ditches, about three feet wide and eighteen inches deep, which occupy many acres. The liquid flows down and back through these furrows until more than one half of the organic matter has been rid of. That is the best they can do under that system. The dirty water remaining is then run into a septic tank in which the anaerobic germs further liquefy it. So that you have first what is known as the sedimentation stage, and second, what is known as the septic tank stage. You have got left nothing more than an amount of organic carbon, ammonia products, sulphuretted hydrogen and carbonic acid, and everything that results from decomposition. That is all they are doing generally in England today in the way of sewage treatment works. Then they allow the remaining liquid to go into the rivers because they have worked out all the stuff that creates a nuisance or is putrescible.

*By the Chairman:*

Q. All the nuisance —A. Yes, all the nuisance. That is all they are pretending to do over there. They do not remove the bacillus coli and the bacillus typhosus. If we wish to do that in Canada we have got to do something like what Doctor Houston does with London water. He sediments it and then runs it on the filter beds of sand. Down in Massachusetts the rate they get to is 150,000 gallons per acre per day. In this way they filter it until the affluent comes out as absolutely clear water with an excess of nitrates in it.

*By Mr. Chabot:*

Q. That is the sand filtration system?—A. That is the system of contact beds and sand filtration. That system has been adopted with a view of getting rid of any putrescent matter. That has been found to be too expensive and too slow and so they have made beds of scoria, or the slag from iron works. These beds are made of jagged pieces of scoria and are full of air spaces. The sewage is sprayed on to these beds and exposed to the air. It is then allowed to run over the scoria beds for four hours, and then intermits for say two hours. The oxygen in the air passes down into the beds and passes the bacteria that have gone into the beds from the septic tank, and the action of the bacteria and the oxygen upon the organic matter enables all the fermentable matter with many bacteria to be got rid of.

Now, what about sewage treatment in Toronto. In that city it would cost to treat a million gallons of sewage, we will say \$10. Toronto pumps about 150 gallons of water per head per day. Take it at 100—that is twice the amount pumped at Berlin, and twice what I think is necessary—that would be 100 times 400,000 people. Therefore Toronto is pumping 40,000,000 gallons of water per day.

*By Mr. Northrup:*

Q. You must add 50 per cent to that. A. Yes, and that would make the total quantity of water pumped, 60,000,000 gallons. Now, under the best French, German or English system—and the wages paid over there are only about one-half of what are paid here—it costs them from \$6 to \$7 per million gallons. If we take the best we can do here—I am not sure that we could do it any cheaper than in the United States, but let us say the cost would be \$10. That would be \$600 a day and over \$2,000,000 a year, which is not capital expenditure at all. What they have done in Toronto is this. They had intended honestly to deal with the sewage question up to

a certain point. They have built along Front street an intercepting sewer for the lower half of the city. On Gerrard street they have an intercepting sewer for the upper half of the city. Both these sewers have been brought down to the Don valley, and down about the marsh tanks have been built. The most they are doing is the running of the sewage into these sedimenting basins. Speaking from memory, it is estimated that they are going to allow each gallon of sewage just fifteen minutes to get rid of what is left in the settling basin. Then the liquid will be pumped into Ashbridge's Bay or be allowed to go out into the lake. That is as far as Toronto has been able to get in its attempt to deal with the sewage problem.

*By Mr. Northrup:*

Q. You say there will be only fifteen minutes for sedimentation?—A. Yes, only fifteen minutes, if I am correct, is allowed for getting rid of any coarse matter just as any sewer end might get rid of it.

*By Mr. Chabot:*

Q. Putting aside financial considerations, what would you suggest should, and could be done by cities and towns situated along navigable streams in this country, cities which have suffered to a large extent from epidemics of typhoid and allied diseases, for the careful and proper disposal of sewage I am asking you to give a general opinion.—A. In my judgment the question resolves itself into this: That all near sources of pollution, such as we have along the shores of the Ottawa here, must be turned away from the source of water supply. Then if there is evidence that you cannot prevent a certain amount of gross pollution there is nothing left at all but to filter the water supply. In Montreal they have got their mechanical filters.

*By the Chairman:*

Q. Does Montreal take its wafer from the St. Lawrence?—A. Yes. It used to take its water from the Ottawa side of the stream, but it now draws it from the St. Lawrence side.

*By Mr. Chabot:*

Q. What you suggest is that there should be sedimentation and filtration?—A. Yes. I am quite prepared to admit that every case must be dealt with absolutely on its local merits. For instance you have Toronto with 60,000,000, gallons of sewage going into its own bay every day and yet pumping water for domestic consumption within four or five or six miles of that. Toronto is exactly in the same position that Chicago was until the latter city turned its sewage into the canal, except for Toronto Island, she has got to depend absolutely upon purification of the water supply. Chicago had 500 to 600 deaths from typhoid fever annually until she turned the sewage into the canal.

*By the Chairman:*

Q. Where does that sewage go to?—A. It goes to the people in Illinois via the Illinois river.

Q. I understand you are discussing this matter largely from the point of view as to how it effects the city itself?—A. And the next city below.

Q. That is what I want to discuss with you. This Committee has been formed for the purpose of ascertaining how we can protect the citizens of Canada, not merely the citizens of Ottawa.—A. That is a point I have been trying to make. The problem resolves itself into one of just how far first of all, it is necessary to purify or treat sewage. Second, just how far that is possible in practice. Take it as we have it. I think I pointed out by illustration in going from sedimentation to the bacteria bed, and to the final filtration, that it can be done. And it can be done at a cost

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of about \$10 or \$15 per million gallons. That does not take out all bacteria. Even at that stage you have bacillus coli and bacillus typhosus theoretically present, bacillus coli certainly present to an extent, even after all this good work, sometimes of 15 or 20 thousand bacteria per cubic centimeter, in this clear water. That goes into the stream, because it is still impure unless you keep putting in hypo at the proportion of about a grain to a gallon.

*By Mr. Chabot:*

Q. Could that pollution be completely removed by mechanical filtration?—A. We are talking now about sewage disposal. With all the purification of sewage we can do we are not turning into the river a stream which is free from bacillus coli. You see my point.

*By Mr. Northrup:*

Q. It cannot be made perfectly pure.—A. If you cannot do more than that the practical question arises in the case of a city like Ottawa, which is polluting an enormous stream; can you get the same results at Hawkesbury or at Montreal in any other way than by purification works? You do by dilution, because at Besserer's Grove, down below where all of our sewage goes, the dilution is so great, because I do not believe there is so much sedimentation in the rapid current which, according to the analysis, made by the Commission two years ago the number of bacteria at Besserer's Grove does not run much above 200 per cubic centimeter.

*By Mr. Chabot:*

Q. Supposing that to dilution is added mechanical filtration, that would reduce the contamination still further?—A. Undoubtedly, you can apply any amount of filtration after you have diluted the sewage.

*By the Chairman:*

Q. What I am trying to arrive at is this: while it may be absolutely possible for the city of Ottawa, according to Dr. Bryce, if it puts its intake pipe into the proper place, to get safe water, it is still pumping sewage into the river. What is the effect of that below. We have evidence here—and I may say I have read works which corroborate everything which has been said as to the distance sewage will carry—from Dr. McCullough and others that Hawkesbury was affected from the sewage of Ottawa, and Dr. Edwards cited in the House of Commons a case where typhoid was traced from one severe case of typhoid for 350 miles and caused an epidemic in a mining town. It is not just what is the effect on the city of Ottawa or the city of Toronto. If they want to poison themselves it is all right, but they have no right to poison their neighbours.—A. I agree absolutely with that position, if it can be shown. The case cited by Dr. Edwards may have occurred, and I can understand it, providing it is a mountain creek. That is not our case, and that is why I say that every case must be dealt with on its merits.

Q. Is it not a fact that in a cold climate like we have sewage is practically kept in cold storage?—A. That is absolutely true that bacillus lives a longer time in cold weather. But one reason why it is not a practical danger is, that in Munich, where the great Pettenkofer made his tests, he found that 75 or 90 per cent of the bacteria were removed by dilution and by sedimentation, within a few miles. I will grant that it is perfectly possible to improve the river if we take our sewage out by doing these things previous to dilution, but no standard that I know of would indicate that practical danger has come from polluting the Ottawa with raw sewage simply because the dilution is so infinite, and I suppose our own case through local pollution is as good an illustration of dilution as any.

Q. If I understand your theory aright, you would say that the water ten miles below Ottawa ought to be just as good as the water ten miles above?—A. It might not be, but bacterial tests show an enormous dilution.

*By Mr. Chabot:*

Q. Notwithstanding the dumping of our sewage into the river?—A. I am only taking any evidence we have as to the number of bacteria in the stream.

*By Mr. Northrup:*

Q. Is it not a fact that at Niagara Falls on the United States side the typhoid fever rate was very high?—A. There is no question about it at all. Why is it? You have Buffalo, a city of half a million, polluting that side of the river. The sewage does not come across, probably because of the enormously rapid stream. The current at the bridge is six miles an hour. The sewage goes down the eighteen miles in three hours. There the sewage current could be watched, for a brief period. It pollutes this surface water, and so comes down to Niagara Falls.

Q. There has been no precipitation?—A. There has not been time for great precipitation. So, I say again, every case must be taken upon its individual merits.

Q. And then, as I understood, they discovered that the water outside of the mouth of the Niagara river was polluted, and that the lake was polluted half way across.—A. The question arises: if you find bacillus coli out in the middle of the lake, is it polluted water in the sense we are dealing with the question. Dr. Connell tells us that outside of Wolfe island Lake Ontario has no bacillus coli in practice. He says that 15 miles down Kingston sewage may be detected on account of the bacillus coli in the river. Beyond that, the dilution is so great that you cannot find bacillus coli in practice until you come to Prescott or Brockville where he says it is due to local pollution. Then, he says after analysing Kingston water for ten years, he finds that there is no practical danger to Kingston from the polluting of their bay where they take the water out some 1,800 feet out. I think, until owing to some cause or other, and in two cases it was a broken pipe, the anchors of the ships having pulled the pipe apart,—Bacillus Coli could be found in less than 10 cubic centimeters of water and in 50 per cent of the samples of 1 c.c. At that point Bacillus Coli has become a positive signal of danger to Kingston in three epidemics. He further points out that there are probably 500 Bacillus Coli to 1 Bacillus typhosus. So it comes to the question: can we take out all bacteria by any system of purification? If we cannot, then how far are you going to carry any system of purification to eliminate the danger from any town? Is it to be universally adopted, or are there conditions, like large streams, where dilution is so great that you obtain the same results that you do with your system of sewage purification?

Q. If the sewage at Kingston were poured into the river, a city below whose intake pipe is a reasonable distance away could safely take water from a point in the river ten miles on the other side of Kingston?—A. No question about it, if dilution is the measure of safety. The only question, Mr. Chairman, I want to get fixed is: What are we going to do in practice. You must not adopt, for instance, an English rule. If you do, you do nothing. That is true. Our rule is not the English rule, because their streams are small and conditions are absolutely different. How far are we going to take measures to protect the large streams, with our small population.

*By the Chairman:*

Q. You say that the water at Kingston could be absolutely pure for use if the sewage was deposited below the intake pipe. What is going to happen to the people of the towns ten miles below?—A. It just depends. The water runs past, like it does at Besserer's Grove. As it would be taken from above the city there is no question as to the town water being polluted. The only question would be: Are these bacteria

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very recent and are they there in such quantity that any given amount of *Bacillus Coli* is present in one, ten, a hundred or a thousand cubic centimeters? What is the ratio of their presence to the amount of water drawn in, and could you do better by any system of purification in keeping them out?

*By Mr. Chabot:*

Q. Supposing, for instance, that East Templeton, Buckingham, Masson, Thurso, Cumberland, etc., were cities, instead of villages or small towns drawing their water from Ottawa, and that there was an epidemic of typhoid in Ottawa. If Ottawa continued to pour its sewage into the Ottawa river, above Rockcliffe, without any treatment whatever, would you say that these cities would be exposed to the same infection that we were suffering from?—A. Certainly they would.

Q. Notwithstanding the dilution or precipitation or anything else?—A. They are exposed to the same nature of danger but not to the same degree of danger. You apply the question of dilution and that will determine it very largely. I won't say the danger is not very much, but the point I want to make clear is what you do here by sewage purification methods to remove that danger? We have not got—and that is the point I am trying to make—any sedimentation, any septic tank treatment, any filtration that will remove them entirely.

Q. But these methods will remove bacteria to a very large extent?—A. It means this, that they say in England or France that you have taken out the element of putrefaction, the smelling element. You have not removed the *Bacillus Coli* present.

Q. But the death rate from typhoid has been very materially decreased.—A. Because of the purification of the water by filtration. I hope the Committee understand me when I say that it is not that I oppose purification. But I do want it made clear that we can in practice pour sewage into enormous waters like our great lakes where there is great dilution, and get a less number of *Bacillus Coli* per cubic centimeter than by the best known methods of purification adopted elsewhere on small streams.

*By Mr. Northrup:*

Q. As I understand it, the Colon Bacilli are the fellows we are after?—A. They come from the intestines of men and animals.

Q. Exactly.—A. And measure the possibility and presence of typhoid germs.

Q. So that the Colon Bacilli are the fellows we want to get rid of, are they not?—A. Yes. You know you get rid of the typhoid germ if you get rid of him.

Q. And he is a pretty hard fellow to obliterate?—A. That is the point I referred to, that the death of the bacillus in water is rapid. Houston tells us that in the experiments in his London Laboratory it was found 99 and a point per cent disappear in a week in raw Thames water; it is a foreign element in water. Now if you take 99 per cent of the bacilli out of the sewage, and take one per cent that is left, you can imagine what the danger really is, especially when you bear in mind the fact that the fellow that is left is probably not dangerous because he has lost his vitality; he is nearly dead, necessarily so when the others are all dead.

*By Mr. Chabot:*

Q. But he will revive quickly?—A. He will not revive as a dangerous germ as far as any evidence that we have goes. He has lost his effective virulence.

*By Mr. Northrup:*

Q. This Colon Bacillus is the one we have to dispose of and we have so far as the streams are concerned, three ways by which we may get rid of him; by the current, by precipitation, and by dilution. Now in the Niagara River it has been shown that if the current is swift it is not an effective factor?—A. No.

Q. If the current is slow there is a better chance of disposing of him?—A. Yes.



Q. And in addition unless the current is so slow as to prolong the opportunities for precipitation and dilution we are not likely to get rid of him?—A. That is right, it is perfectly clear, that is exactly the situation. Now what happens? The probability in most cases is that cross currents winds, &c. add enormously to dilution. Thus at Aylmer the westerly winds blow the sewage against the sands along the shore, and if we are not getting it in our water supply it is because of the conditions of the river, the real reason being sedimentation plus dilution. I agree with the Chairman that it is quite possible to deal with bad sources of pollution so as to make it more effective, but you are not to suppose that you can take out the *Bacillus colon* or the *Bacillus typhosus* absolutely except at very large cost.

Q. We are here as a Committee to report to the House some means of avoiding this evil. Can you give some suggestion as to what should be done to effect that purpose.

—A. In my judgment the situation in Canada to-day is that you must have a carefully selected board consisting of trained sanitarians, biologists, chemists and engineers who are really thoroughly competent and experienced.

*By the Chairman:*

Q. You mean trained sanitary engineers?—A. Yes, plus biologists and chemists; they are absolutely necessary. Then after you have done this make the law so general that it will enable them to have the law applied, under whatever Minister they are placed in any specified case they may have investigated and passed upon, in accordance with their recommendation. You see the problem in all cases is not the same. In one case you have cities like Toronto and Ottawa emptying their sewage into large bodies of water where the amount of dilution is great, and then you have cases like the town of Berlin which did empty its sewage into a small creek, and the amount of dilution is small. If you do not leave it to your Board to discriminate as to the amount of purification it is clear that it would be a grave injustice to the larger place to do as much as the smaller place in order to make the effluent good. If your law is adequate, and the board constituted under that law has sufficient power, then, as far as I can see, you are safe. The chief point is for that board to act in co-operation with the local municipality and the Provincial authorities so that it can do just what the Marine Hospital or Public Health Service is doing to-day in the United States. The last named body waits until it is asked, in a certain sense, to come into a State and go to work on a difficult problem with all its experts and suggest a solution. The Canadian Board should have sufficient power to see that what is proposed is carried into effect.

Q. In order to carry on that idea, sanitary engineers will be necessary?—A. Certainly.

Q. Are there any such sanitary engineers in Canada today?—A. I think there are several well trained men as biologists as well. The only point is that they have not been brought together in a group to work out their engineering, sanitary and biological problems, and so give them a standing.

*By Mr. Chabot:*

Q. Are there any universities that give that special training in Canada?—A. In answer to that let me say that in 1891-92 the town of Berlin had a law suit on its hands, and it appealed to the Ontario Government to make some experiments in the treatment of sewage in order to tell them what to do. The Provincial Government established a biological station at Berlin and maintained it for a number of years. The Provincial Biologist and Chemist, Doctor Amyot, was detailed for the work and carried it on for several years with very satisfactory results. There have been trained through that station, which has been moved to Toronto, a number of young men

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who have carried on that particular work as it has been carried on at Lawrence, Mass., for the last twenty years.

Q. These young men have been carrying on biological work?—A. Yes.

Q. What about the engineering part of it?—A. Some of these young men have been trained in the engineering part of the work also. The difficulty has been that there have not been enough of jobs to encourage them to remain on the work long enough. If, however, you establish a Board such as that referred to, with a chief who is familiar with these large problems these young men can be trained in the larger problems of biology and chemistry and engineering.

*By Mr. Northrup:*

Q. Suppose such a Board is formed and it proceeds to carry out its ideas, it would be in a position to recommend whether assistance should be granted by the Dominion in order to aid in solving sanitary problems?—A. Exactly so. That is the point I have tried from the beginning of this examination to make. Different remedies must be applied to different cases, as in England, whether it be a large or small river, or a large or small town. It must be determined what treatment is necessary to the safety of that town and also to the safety of the town below it. If what is suggested were carried out it would mean an enormous advance on our present situation.

Q. If all these suggestions were carried out, would there be a great reduction in the death rate from typhoid in Canada?—A. In that event we could reduce in a very few years the death rate from typhoid fever in urban municipalities, where the great bulk of the deaths occurs from 30 deaths per 100,000 down to from 10 to 15 per 100,000.

Q. You spoke of 30 deaths per 100,000. I think in one of the official reports the death rate is given as 36 per 100,000.—A. I am giving you the figures approximately for the purpose of illustration. The primary difficulty, as has been found in England, has been to tell where the limit of purification would be in ten years' time. Over there the municipalities have said: 'We want that settled so that you cannot come to us after we have spent hundreds of thousands of dollars, and tell us that the scheme we have carried out is no use, that we have got to start all over again.' Mr. Northrup will remember that in Peterboro a big law suit took place over the emptying of sewage into the Otonabee River, which resulted in Judge Ketchum going there and acting as arbitrator. There were the township authorities on one side and the town authorities on the other. The Provincial Board of Health wanted to see Peterboro, with a population then of about nine or ten thousand, provided with a sewage system, but the municipality of the town did not know how to carry it out. Mr. Allan McDougall, then of Toronto, went to Peterboro and laid out a very complete system, the first appropriation for which amounted to \$20,000. The plans came before the Provincial Board and we said to Mr. MacDougall: 'Get your outfall and sewer at such a point as that when you have to purify your sewage you can do it by gravity instead of having to pump it.' He did so. Had we told the municipality then to also put in sewage purification works to the extent of fifteen or twenty thousand dollars more they would have agreed to the primary installation. The Board then told the municipality that it would be allowed to use the Otonabee on the understanding that if any damages could be shown to result from the emptying of the sewage into that stream, the town would be made responsible for it. The sewer pipe had to go into the township but the township authorities took out an injunction and prevented the town of Peterboro from doing that. The result was that the engineer and city solicitor of Peterboro came to the Provincial Government and in consequence of their representations, new legislation was enacted. In the case of Peterboro, the legislature actually gave the town four years to pollute the Otonabee River whether it did any harm or not. That was of course an extreme case. The problem has not yet been solved so far as the Otonabee River is concerned, and they are only beginning to deal with the purification question there this year. Up to now the raw sewage has

been going into the river. The case illustrates the necessity of having some central board, with adequate powers, so that it may induce a municipality to carry out promptly any schemes that are recommended.

*By the Chairman:*

Q. Does not the very case you have cited show the absolute necessity of having some Federal Board that can compel the municipalities of cities and towns to carry out these works?—A. Power should exist somewhere.

Q. You say that the town of Peterboro would not, if you had indicated that you wanted a purification plant installed have put in its sewerage system?—A. No.

Q. Had there been a proper Federal law on the statute book the town would have been obliged to put it in?—A. Remember that in our opinion it was better to have the town partially sewered than not to have any sewer at all. Those were the old days when public opinion was not very enlightened on this question.

Q. We are talking here of what we are to do in the future.—A. I am quite sure that in every case a Federal Board, if it is properly organized with efficient officers, will be of infinite value in the solution of just such problems as I have mentioned, because it will have at its command the services of practical men.

Q. And such a Board must have power to enforce its decrees.—A. It must have the necessary power. And in the carrying out of its policy it must be practical as well as theoretical. It must not take the stand that the machinery for purification that would suit a small place which empties its sewage into a small stream would be applicable to a big city where there is very great dilution. That is not good sanitation and it is not good practical politics.

*By Mr. Chabot:*

Q. Then you think that stringent and well defined sanitary laws should be enacted by the Federal authority?—A. Yes.

Q. And a Board, or Boards, given the power to enforce them.—A. Yes. That is exactly what they have done in England for forty years, ever since they passed the Rivers Pollution Act in 1853.

*By Mr. Northrup:*

Q. What would you think of such a suggestion as this: That this Committee recommend the creation by the Dominion Government of such a Board, and that it advise the calling of a Conference of the Provincial Premiers and representatives with the Dominion Government in order to discuss the local difficulties and see what degree of co-operation can be secured between the Dominion and the Provincial Governments.—A. To my mind it is essential that such a thing be done. Speaking frankly, I have grown absolutely hopeless over the situation. After over thirty years of public health work I have seen nothing coming along until I have despaired. Positively the phrase 'public health' seems to have lost any practical meaning, to me and reforms apparently can only now be carried out in the way that Mr. Northrup suggests.

*By Mr. Chabot:*

Q. During your term as Secretary of the Provincial Board of Health you made many recommendations of the kind?—A. I have kept at it until I have grown gray over the subject.

*By Mr. Northrup:*

Q. And heart sick?—A. And heart sick.

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*By the Chairman:*

Q. Would not this suggestion commend itself to you: the Committee has already secured some valuable evidence and should continue its work next session. Then we might formulate a bill to carry out the desired projects and summon a conference of Provincial representatives with the Dominion authorities in order to examine the proposed bill and give us the benefit of their suggestions and co-operation.—A. That cannot be done during the present session, but would it not be possible for the Committee to make an interim recommendation that a Conference such as proposed be held? The Conference having met and the Committee having obtained its views, a Bill could be drafted and passed next session.

Mr. NORTHROP.—My idea was this: apparently, unless something is done very quickly, we will have wasted all our time as far as practical results are concerned this session. We have taken enough evidence to show the gravity of the situation and the importance of something being done. I would suggest, as a rough scheme, recognizing the local difficulties as between the Dominion and the Provinces, that a Conference be called, to which representatives from each of the provinces be invited to discuss the subject with the Dominion Ministers and see if they cannot agree upon some legislation which might be passed concurrently by the Dominion Parliament and the local Legislatures.

The WITNESS.—Then next year you have got your Bill and your expression of opinion

Mr. NORTHROP.—Action might be taken right at the beginning of the session.

The WITNESS.—Exactly.

The CHAIRMAN.—I think that could be done by way of a recommendation.

The WITNESS.—Probably you could call a Conference, or have a Conference called, in September. It would enormously forward your work, if you could get into practical and harmonious working with the various Provincial Governments. If I might make a suggestion I would say that the question of state rights has been much more acute in the American Union than it has been in Canada. Nevertheless the Marine Hospital Service which is now the Public Health Service of the United States, has got so close to the State authorities that there is no difficulty now in indicating what kind of work is required in a technical way, and supplying the men for the carrying out of that work.

*By Mr. Northrup:*

Q. The Province of Ontario has gone so far in its legislation on this subject that it will not permit cities or towns to issue debentures for sewerage purpose unless the plans have been first approved by the Provincial Board of Health.—A. Just so. But difficulties occur in the practical working out of the law. For instance, the town of Peterboro' has asked what standard of purity is demanded by the Board of Health. Do you know, Mr. Northrup, what it has been told the standard of purity is in regard to the Otonabee River?

Q. I have no idea.—A. If as is suggested, they have got to produce means, by which no *Bacillus coli* or *Bacillus typhosus* goes into the Otonabee River; they might just as well stop the attempt at precipitation.

*By the Chairman:*

Q. I understand you have prepared some memoranda to submit to the Committee? —A. I have some notes here, and I will hand them in so that they may appear on record.

I have read the evidence given before the Committee and am quite in accord with the general principle that in many communities with increasing population

municipalities should not be allowed to pour sewage wholly untreated and raw in to streams in Canada, whether navigable or other, since all streams in populous districts are incidentally used as sources of drinking water occasionally, near points of pollution.

2. But regarding the many general statements made in the evidence of the possible dangers due to pollution as proved by *B coli* being found in the waters of our Great Lakes many miles from the source of urban pollution. I would say that in my judgment this has little practical meaning, for so far as my memory goes there has never been known an outbreak of typhoid along the shores of our Great Lakes or on the St. Lawrence or the Ottawa our two main streams, fairly traceable to the sewage from cities where it has taken in its flow more than twenty-four hours, and probably much less, between the point of pollution and its possible use as a public water supply.

3. I have been particularly interested in the evidence of Dr. Connel of Kingston, as it bears on this point, since he points out, First: That Lake Ontario beyond Wolfe Island is proved practically free from *B coli* the ordinary evidence of pollution; Second: The positive evidence of pollution by Kingston sewage may be found fifteen miles down the St. Lawrence, but only in one-half of one-hundred (100) c.c. samples and it will be further remembered that the current of the river has there become very rapid. He points out, further, that for each *B Typhosus* there are probably 500 *B coli* poured out into raw sewage; Third: That while local pollution is constant in Kingston Bay yet Dr. Connel with ten years' constant observation and analysis states that in practice in a city having, as he says, constantly probable typhoid carriers, and therefore daily pollution of the bay water, outbreaks of typhoid do not appear in that city in even sub-epidemic form unless *B. coli* appears in the water so as to be detectable in an amount under 10 c. c., and only then when such are detected in fifty per cent of samples of 1 c. c. is the danger great as judged by typhoid in 1903-09-10, due to inshore pollution from a broken pipe. The same sort of evidence has constantly been present at Ottawa during the last 25 years, if we are to judge from the deaths year by year, and then it is only when what we may call local, or immediate and gross pollution has been present, that outbreaks of an epidemic character have occurred in Ottawa, or, in my experience, in any of the other numerous outbreaks which I have studied during the last 30 years; and fourth: Seldom does pollution occur in the river below Kingston in local water supplies, whether at Prescott or Brockville, and these he believes due to pollution from the sewage of those towns. We understand, therefore, how this comes about when we realize that both these germs, from the intestines of animals are in a foreign medium in river water and therefore tend to die out according to Dr. Houston's experiments on Thames water in a laboratory experiment, to the extent of over 99 per cent of the total typhoid bacteria within a week while any left have probably lost their virulence. But in addition to the tendency to die rapidly in water these sewage germs are subject to the even more important influence of sedimentation in bays and slow moving water, since at the rate of one foot per minute in sewage disposal works from 50 to 70 per cent of the organic matter is thus removed. But if we add to this fact the further influence of dilution as we have it in the Great Lakes and rivers like the Ottawa and St. Lawrence we will understand why epidemics or outbreaks of typhoid under existing conditions of pollution have not occurred. For instance the flow of the Ottawa has an average of 50,000 cubic feet per second or in one minute as much water passes a single point as makes up the sewage of the city in a whole day; or, to express the dilution in common terms, the 18,000,000 gallons of Ottawa sewage is diluted 86,400 times by the river. So great is this that even six miles down samples taken do not show more than 100 to 200 bacteria per c. c. Similarly, the pollution at Aylmer, about one fiftieth part of that of Ottawa, quite apart from the effects of sedimentation in the shallow water

along the shores of Lac DesChenes, is as one part of sewage in 4,320,000 parts of water. When we realize that this sewage itself contains, as does ordinary sewage only about 100 parts of organic matter, largely inert carbon, in 100,000 parts, we must dilute it 1,000 times more still, or there is but one part of organic matter in 4,320,000,000 parts in Ottawa River water as polluted by Aylmer, with the result that, however improper in theory, the town of Hull which drinks raw river water has never been afflicted with an epidemic of typhoid except from its own local pollution, while the same may be said of Ottawa.

Now, when we compare this dilution with the standards required by the Royal Commission on Sewage Disposal in England, which is proposing that where the dilution of sewage is over 500 times no purification works will be required except screens to remove gross material before discharge into the stream, while with dilutions of from 150 to 300 times, six parts per 100,000 of suspended solids is permissible, we can see that as a matter of fact we in Canada have not and are never likely to have conditions on either the Great Lakes or the navigable waterways of Canada creating any sewage pollution problems to which we must apply English rules in which it is not pretended to keep rivers pure, but only that at the most they do not create nuisances either aerial or by deposit along the banks.

4. If then the question is asked whether or not treatment of sewage by our cities and towns is necessary I would say, as the evidence of thirty years has shown, that from the purely health standpoint the answer must depend on quite local circumstances. Nearly every epidemic on this Continent has been shown to be due to local, immediate and gross pollution, nearly always by a town polluting its own supply or that of its immediate neighbour, as Buffalo polluting Niagara Falls supply or its own supply, or Chicago, Cleveland or Toronto their own supplies or Walkerville polluting Windsor supply.

But while this is true there is no good reason why there should not be laws adequate to prevent pollution by Municipalities in all such cases as those indicated as well as insisting that they insure by sedimentation, filtration or other methods the purity of their own water supply.

In all the evidence given before the Committee I observe that but little has been stated as to what methods of treatment of sewage are of practical adoption or what standards of purity are to be set for the towns of Canada. If no local nuisance, evident to the senses, results owing to dilution, then no English rule will apply since the most they say is not freedom from bacteria but merely whether the sewage contains when poured into the stream putrescible matter capable of creating a local nuisance. The term 'Sewage Purification' has frequently been used; but in England where the greatest amount of work has been done it is now apparent that the only term applicable is 'Sewage Treatment' to the extent indicated, since fifty years have shown that in a country with 800 per cent of its population in its cities crowded together on a few relatively small streams anything further has proved impracticable. How far then, ought we to go in demanding sewage treatment in Canada as a measure of public health safety?

5. Mr. Race, bacteriologist of Ottawa, states the average cost of purifying sewage in America as being about \$11 to \$15 per million gallons. This would mean for Ottawa \$1,000,000 per annum, and it must be remembered that even this is not intended to make the effluent into the stream free from bacteria. If we say that wherever *B. coli* is present then *B. typhosus* may be present, then the removal of these means the purification of sewage up to a point where practically no bacteria are found in the effluent. The fact of the matter is that with filtration after all the preliminary work of removing the gross material has taken place, the financial burden will prove, as it has proved elsewhere, so great as that such a degree of final purification will not finally be insisted upon in practice. This will be appreciated when it is stated that when what is called by Calmette the mineralizing stage of



purification has been reached and the sewage is on its way to final treatment on the sprinkling filter or contact bed there still remains 40 parts of organic matter in every 100,000 parts of sewage. This it will be understood is 4,000 times as much organic matter as there is, for instance, in the Thames and yet more than there is in the Ottawa River. The best working sewage disposal works at Lawrence Mass., where the experiments have been carried on longer than anywhere else, show the amount of organic matter daily consumed to be 2.5 grammes per square metre, or about the equivalent of 150,000 gallons of sewage per acre per day. We could not expect, for instance, to do better on Kettle Island with Ottawa sewage although it is all a sandbank and if laid out as a sewage farm it would require at least 80 acres of beds to perform work equal to that at Lawrence. Or, to put it in another way, if it takes at least a fortnight of sedimentation with Thames water containing only .0167 parts of albumenoid nitrogen per 100,000 parts, with an average of 5,000 bacteria per c. c., and a rate of filtration over perfect filter beds of sand 5 feet deep at a rate equalling 2 feet per square foot of surface per hour, or 2,000,000 gallons per acre per day to reduce the total bacteria in the water from 400 after sedimentation to below 100, it is hardly necessary to say that similar bacterial reduction by any imaginable economic process for sewage would prove financially impossible. What then, is the most we have a right to expect and what ought we to do?

6. Professor Calmette calls the first stage of purification decantation or applies it to what we call the sedimentation of all matters in suspension in sewage to the extent of from 50 to 70 per cent of the total organic matter. This is effected mechanically by grills, by centrifugal machines, &c., and flowing through a series of ditches or sluices at a rate of about 1 foot per minute. During this process it is essential that the sewage should not remain stationary long enough for decomposition to take place, the problem being the disposition of the sludge or deposited matter which amounts to about 3 pounds of dry solids per cubic yard. The wet sludge usually contains about 90 per cent water. If the raw sewage is run slowly through ditches, say, a yard wide and 18 inches deep, the sludge depositing along the ditch and the water separating from it both by evaporation and soakage allows of as much as 1,000 tons per acre to be deposited annually while the field being cultivated is capable of growing large crops each alternate year. Thus at Birmingham some 150 acres of such beds are required. To effect such results it is plain that large areas of sandy, permeable soil are necessary; indeed, this has proved to be the least expensive and most practical way of disposing of sludge which has not enough nutritive value in it to make it valuable as a manure by pressing, while burning is yet more costly.

7. Having in this manner disposed of from 50 to 70 per cent of organic matter there is the balance of 30 per cent to be dealt with. This it is found can best be done by running the sewage into tanks of various designs where decomposition through fermentation through the action of microbes liquifies the remaining organic matter and where the spent carbon will be deposited. This is called the second or liquifying stage of bacterial treatment through septic tank action. The sewage now wholly liquid must be finally dealt with either by discharging it directly into some stream or by its further treatment on what are known as bacterial beds.

8. The third or final treatment of the sewage is with a view to removing as far as may be possible both the bacteria present and the organic matter of a putrescible character still remaining. The action as carried on is essentially due to what are known as nitrifying bacteria acting always in the presence of free oxygen. This is effectively carried out wherever the sewage is intermittently applied on either natural beds of coarse sand or on artificially made beds of sand and gravel or beds made up of broken scoria. For instance, the filter beds in Massachusetts purify well 150,000 gallons per acre per day, while the city of Paris attempts to handle some 300,000,000 gallons on 12,000 acres and grows crops as well, or 25,000 gallons of sewage per acre

is utilized daily. Such methods however, are now far surpassed by coarser beds made of cinders or scoria which are piled loosely, making rapid filtration possible through the intermittent application of the sewage applied by sprinklers or other method for several hours with an intermission during which the sewage flows away, leaving the particles of organic matter deposited and which is there largely destroyed by the action of bacteria in the presence of the free oxygen which circulates through the bed. Such a bed can easily treat some 200 gallons per square yard of surface daily or one hundred times as much as a natural bed of sand filter, that is, about 2,000,000 gallons per acre per day. The effluent from such a bed will not be putrescible but will still contain a large number of bacteria. If it is determined to purify this still further it may be passed over a filter bed of sand, or if it is wished to destroy the *B. coli*, present hypochloride of lime to the extent of one grain to one gallon may be added to the effluent with some fair degree of success. European experience teaches that the three several stages of sewage treatment thus described without the final chemical treatment may be carried out at a cost of about \$7 per million gallons; but if similar treatment were applied in Canada, American experience shows that it would cost at least \$10 per million gallons or about \$200 per day for Ottawa, with the present consumption of water. It is apparent, therefore, that one of the first steps in the reduction of cost of sewage treatment in Canada is to reduce the abnormally large amount of water commonly supplied to Canadian towns. If the 200 gallons a day supplied were reduced to at least 50 gallons in many Canadian and American towns by placing meters upon every water service and causing payment to be made for amount consumed, it would be quite possible to very notably decrease the cost of sewage disposal wherever such is found necessary. As, however, the *B. coli*, and *B. typhosus* are not all removed by even so complete a system as has been described and as any such treatment will commonly mean costly intercepting sewers and extensions to the disposal works on land which means large areas to be purchased it will be evident that few towns in Canada will be able under existing circumstances financially to instal such except under most favourable conditions. In view, therefore, of the fact that even this refined treatment does not remove all the *B. coli*, which bacteriologists assure us is a measure of possible danger from the presence of typhoid bacilli, it will probably be agreed that the preliminary treatment by stages No. 1 and 2, as already described, viz.: sedimentation and septic liquefaction, will be all that is found either necessary or practicable with the enormous dilution commonly possible in the streams in Canada. At any rate, if this is done we in Canada shall have gone much further in sewage purification than that proposed in the last report of the Royal Commission on Sewage Disposal for England. Further, in every case where streams are polluted in any sense near to the intake of a public water supply it is evident that adequate purification of the water supply itself by either sedimentation, filtration, or by both, will always be essential to permanent safety.

The CHAIRMAN.—We are much obliged to you for your attendance this morning and your kind co-operation.

The WITNESS.—If I can be of any use to you at any time I shall be at your service.

Witness discharged.

Committee adjourned.

SELECT SPECIAL COMMITTEE

ON

POLLUTION OF NAVIGABLE WATERS

APPENDIX.

EXHIBIT No. 1.

BILL TO PREVENT THE POLLUTION OF NAVIGABLE AND OTHER WATERS.

*(Drafted by Commission on Conservation.)*

1. No person, corporation or municipality shall place, or permit to be placed, or discharge or permit to flow into any navigable or other waters of the Dominion of Canada.

(a) The solid refuse of any manufactory or manufacturing process, quarry or mine, or any rubbish or cinders, or any other waste, or any putrid solid matter.

(b) Any solid or liquid sewage.

(c) Any poisonous, noxious or polluting liquid or colouring matter proceeding from any factory or manufacturing process, except in the manner and under the conditions prescribed by regulations to be approved of and published by 'The Minister' and upon permit of said minister or his deputy.

2. On and after the passage of this Act (or date to be named) it shall be unlawful for any person, corporation or municipality or government who at the time of the passing of this Act are contravening the provision of Section 1 of this Act, to continue so to do if in the opinion of 'The Minister' after official investigation and, if necessary, inquiry under oath, the continuance of such act or acts is a menace to the public health.

3. The minister is hereby authorized to issue such regulations and orders as may be approved by the National Council of Health for the purposes and intent of this Act—the same to become law from the date of the publication in the *Canada Gazette*.

4. Any corporation or municipality contravening any of the provisions of this Act or of any regulation or orders of the Minister or of his Deputy shall be subject to a penalty of \$500, and \$50 per day for each day the offence is maintained after notice has been served to discontinue the same, or, if the offence is made without permit of the Minister or of his Deputy. In like manner any individual so contravening shall be subject to a fine of \$50 and \$10 for each day the offence is maintained, or by imprisonment not exceeding two months, or both, at the discretion of the magistrate.

5. Any order or decision of the Minister or his Deputy shall be subject to an appeal to any high court of the province in which the offence is committed, or to the Supreme Court of Canada, and said court shall have power to hear said appeal and may affirm or set aside said order or decision or modify the same, or otherwise fix the terms upon which permission shall be granted—but the order or decision appealed from shall not be superseded by the appeal; but shall stand until the order of the court as above.



EXHIBIT No. 2.

(Submitted by Mr. Joseph Race, F.I.C.)

ANALYSES OF WATERS IN THE GREAT LAKES.

	Free ammonia	Aluminoia ammonia.	Nitrates.	Nitrites.	Ox. consumed.	Chlorine.	Total.	HARDNESS.			
								Permanent.	Temporary.	Turbidity.	Colour.
Port Arthur.....	0	·056	·325	Tv.....	2·88	1	48·5	66·5	18·	30·	0
Sault Ste. Marie.....	0	·029	.....	.....	1·77	1	56·1	46·1	0	1·5	0
Kincardine.....	·01	·060	·160	Tv.....	.....	3	116·	92·	24·	2·	0
Goderich.....	0	·045	·090	·0005	1·00	3	111·	100·	11·	45·	0
Sarnia.....	·01	·045	·092	·0028	1·15	3	120·	93·	27·	3·	0
Courtright.....	0	·048	·093	·0015	·74	4	116·	94·	22·	3·	0
Windsor.....	0	·070	·180	.....	.....	8	126·	102·	24·	45·	0
Bridgeburg.....	·008	·050	.....	.....	1·61	8	128·	112·	16·	1·5	0
Toronto.....	·012	·048	·153	·0045	1·45	8	148·	98·	50·	4·	0
Brockville.....	·013	·057	·087	Tv.....	1·06	8	147·	95·	52·	2·5	0

RESULTS in parts per million taken from the statistics of Dr. John A. Amyot of Toronto, in the American Journal of Public Hygiene, August, 1909, Page 473.

	Approximate dimensions.	Average depth.	Elevation above sea level.
Lake Superior .....	350m + 150m	900	600
Lake Michigan.....	300 + 80	800	576
Lake Huron.....	300 + 120	900	574
Lake Erie.....	225 + 70	120	565
Lake Ontario.....	200 + 50	500	247

EXHIBIT No. 2a.

(Submitted by Mr. Joseph Race, F.I.C.)

BACTERIOLOGICAL CONDITION OF OTTAWA RIVER.

Samples taken 15 feet below surface above the Canadian Pacific Railway bridge, north channel of river:—

	BACTERIA PER CCM. AGAR.		PERCENTAGE OF SAMPLES SHOWING BACILLUS COLI IN			
	2 days at 20°C.	1 day at 37°C.	50cc.	10cc.	1cc.	1/10cc.
September, 1912 .....		8	100	100	30	0
October .....	84	13	100	100	16	0
November .....	132	24	100	95	15	0
December .....	138	12	100	94	42	0
January, 1913 .....	127	12	100	84	23	0
February .....	71	7	100	100	29	4
March .....	11,279	69	100	100	50	29
April .....	9,741	34	100	100	69	15

Each of the above figures represents the average of about 25 determinations.

EXHIBIT No. 3.

MEMORANDUM RE COST OF SEWAGE TREATMENT.

(Submitted by Mr. James White.)

Respecting the cost of treatment, the town of Berlin, Ontario, with an approximate population of 10,000, treats its sewage in septic tanks. After treatment, the effluent is pumped up fifty feet to natural sand beds, whence it passes downward through the sand, the water reappearing at a lower level, as springs. The filtrate thus obtained is perfectly clear and odourless, and, in appearance, cannot be distinguished from spring water. The volume of sewage has now reached 700,000 gallons per twenty-four hours, and the filtering material is not sludged up in the slightest degree. The plant was designed for the present population of 10,000, with allowances for extensions sufficient to handle the sewage of three times the present population. Berlin is an inland town, and is situated on a small stream that has a very small summer flow. The actual cost was \$45,750, and is regarded by sanitary engineers as one of the most efficient plants in the Dominion.

As indicating the cost to a small municipality, Palmerston may be cited. The cost for a population of 2,000 was estimated at \$15,900. Of this amount, \$2,200 was estimated cost of drain to the Maitland river, due to the peculiar topography of the locality, and constitutes an item that would not be involved in a great majority of cases. Deducting this unusual item, gives a cost of \$13,700, or say, \$7 per head of population. In explanation of the cost, it should also be stated that it is proposed to give a complete treatment in a plant provided with both sprinkling filters and septic tanks.

For small municipalities, with very limited financial resources, a sewage treatment with a revolving screen to remove the solids, and subsequent sterilization with hypochlorite, could probably be installed at a cost of about \$3 per head of population. It should be a separate system, to avoid the necessity of handling storm water. This would ensure a fairly constant flow, and thus avoid irradical changes at short intervals in the amount of hypochlorite used.

For a large city, the experience of Baltimore shows that a very complete system, providing for, (1) rapid sedimentation, (2nd) sprinkling filter, and (3) secondary sedimentation, can be provided for about \$6 per head of population. The Baltimore plant also provides for a fourth treatment with hypochlorite. This, however, is perfectly unnecessary, but is used to guard against any possible infection of the very valuable oyster beds below the city.

#### EXHIBIT No. 4.

### PROVINCIAL AND STATE LAWS ON SEWERS AND SEWERAGE SYSTEMS AND MEMORANDUM THEREON.

*Compiled by Dr. C. A. Hodgetts.*

*Alberta.*—Section 24. When the construction, alteration or extension of a common sewer or system of public sewerage shall be contemplated by the municipal council of any municipality, or village, or by any person or body corporate, such council, person or body corporate shall submit to the provincial board all plans and specifications in connection with the construction, alteration or extension of such common sewer or system of sewerage and in connection with the purification and disposal of the sewage.

(2) No common sewer or system of sewerage shall be established or continued unless there is maintained in connection therewith a system of sewage purification and disposal which removes and avoids any menace to the public health, and the provincial board may call for and any council, person or body corporate shall, when requested, furnish as soon as may be, such information and data in relation to such matters under their control as the provincial board may deem necessary; provided that with regard to systems in operations at the date of the passing of this Act the provincial board may dispense with the requirements thereof for a sufficient time in their opinion to permit of compliance therewith.

(3) It shall not be lawful for any such council, person or body corporate to construct, alter, extend or operate any common sewer or system of sewerage or sewage disposal without first obtaining from the provincial board a certificate, signed by the chairman, stating that the proposed construction, alteration or extension may be carried out, and the constructed or extended common sewer or system of sewerage and sewage disposal maintained and operated without injury or danger to the public health.

(4) If in the opinion of the provincial board for the purpose of guarding against injury or danger to the public health, alterations or additions are necessary in any existing or proposed common sewer or system of sewerage or in the plans or specifications for sewage disposal or in both the plans and specifications submitted as aforesaid, the said certificate may specify the alterations and additions deemed necessary and it shall not be lawful to construct, establish or operate the existing common sewer or system of sewerage or sewage disposal of the proposed system or extension unless and until the alterations and additions specified in the said certificate have been made and adopted.

Section 25. The decision or certificate of the provincial board with regard to such alterations and additions or to the construction or extension of any common sewer or public system of sewerage or sewage disposal or of any system of waterworks or public water supply shall be subject to appeal to the Lieutenant-Governor in Council, such appeal to be made and taken within three months after the receipt by the person affected of the certificate or notice of the decision complained of; and such decision or certificate, when not so appealed against or when confirmed or amended and confirmed upon appeal by the Lieutenant-Governor in Council, shall be binding and conclusive in all respects; provided that whenever, in reference to any of the



matters aforesaid, it shall appear that any change of circumstances or conditions has arisen or exists, the provincial board may make further inquiry and may file a further or supplemental decision or certificate, which shall be subject to appeal in manner and have in all respects the force and effect aforesaid.

*British Columbia.*—Section 24. When the construction or extension of a common sewer or of a system of public sewerage shall be contemplated by the municipal council of any municipality, or by any person or body corporate, it shall be the duty of such council, person or body corporate to submit to the provincial board all plans and specifications in connection with the construction or extension of such common sewer or system of sewerage.

(2) The provincial board may call for, and such council, person or body corporate shall furnish, as soon as may be, such further information and data, in addition to the said plans and specifications as the provincial board may deem necessary.

(3) It shall not be lawful for any such council, person or body corporate to construct or extend any common sewer or system of sewerage without first obtaining from the provincial board a certificate, signed by the chairman and secretary, stating that the proposed construction or extension may be carried out, and the constructed or extended common sewer or system of sewerage maintained and operated without injury or danger to the public health.

(4) If in the opinion of the provincial board, for the purpose of guarding against injury or danger to the public health, alterations are necessary in the plans and specifications submitted as aforesaid, the said certificate may specify the alterations so deemed necessary, and it shall not be lawful to construct, establish or operate the proposed system or extension unless and until the alterations specified in the said certificate have been made and adopted.

*Manitoba.*—Section 28. Whenever the establishment of a public water supply or system of sewerage shall be contemplated by the council of any city, town or village municipality, it shall be the duty of the said council to place itself in communication with the Provincial Board of Health, and to submit to the said board before their adoption all plans in connection with said system.

(a) It shall be the duty of the Provincial Board of Health to report whether in its opinion the said system is calculated to meet the sanitary requirements of the inhabitants of said municipality, whether any of its provisions are likely to prove prejudicial to the health of any of the said inhabitants, together with any suggestions which it may deem advisable, and to cause copies of such report to be transmitted to the Minister of Agriculture and Immigration, to the inspector and to the clerk of the municipality.

*Nova Scotia.*—Section 60. When the establishment of a public water supply or system of sewerage is contemplated by the council of any city or town, or by any corporation, such council or corporation shall submit all plans in connection with such supply or system to the Governor in Council, and no work on such supply or system shall be commenced until the plans have been approved by the Governor in Council.

*Ontario.*—Section 30. (2) Whenever the construction of a common sewer or of a system of public sewerage is contemplated by the council of any city, town or village, it shall be the duty of the council to place itself in communication with the Provincial Board of Health, and to submit to the board before their adoption all plans in connection with said sewer or sewerage system. It shall be the duty of the Provincial Board of Health to inquire and report upon said sewer or system of sewerage, as to whether the same is calculated to meet the sanitary requirements of the inhabitants of the municipality; and as to whether such sewer or system of sewerage is likely to prove prejudicial to the health of the inhabitants of the municipality or of any other municipality liable to be affected thereby.

(3) The Provincial Board of Health may make any suggestions or amendments concerning the plans submitted, or may impose any conditions with regard to the

construction of such sewer or system of sewerage or the disposal of sewage therefrom as it may deem necessary or advisable in the public interest; and the construction of any common sewer or system of sewerage shall not be proceeded with without being reported upon and approved of by the Provincial Board of Health, and no change in the construction thereof or in the disposal of sewage therefrom liable to injuriously affect the public health shall be made without previous submission to and approval by the said board.

(4) The decision or report of the Provincial Board of Health with regard to any system of water supply or any common sewer or public system of sewerage or the disposal of sewage therefrom shall be subject to appeal to the Lieutenant-Governor in Council, such appeal to be made within one month after the filing of the report or decision in the office of the minister of the department to which the Provincial Board of Health is attached and such decision or report, where not so appealed against, or where confirmed or amended and confirmed upon appeal by the Lieutenant-Governor in Council, shall be binding and conclusive upon all the municipalities and persons affected by the same; but wherever it appears that any change of circumstances or conditions has arisen, the Provincial Board of Health may, if it deem it advisable, make further inquiry and report as to any system of water supply or common sewer or system of sewerage or the disposal of sewage, which report shall be subject to appeal as aforesaid and have the same force and effect as aforesaid.

(5) The said Board may from time to time modify or alter the terms and conditions as to the disposal of sewage imposed by any award authorizing any system of sewerage or the extension of a sewer, and their report or decision shall be subject to appeal as aforesaid.

(6) No sewage, domestic or factory refuse, excremental or other polluting matter of any kind whatsoever, which, either by itself or in connection with other matter, corrupts or impairs, or may corrupt or impair, the quality of the water of any source of any public water supply for domestic use in any city, town, incorporated village or other municipality, or which renders, or may render, such water injurious to health, shall be placed in or discharged into the waters, or placed or deposited upon the ice of such source of water supply, near the place from which any such municipality shall or may obtain its supply of water for domestic use, nor shall any sewage, drainage, domestic or factory waste or refuse, excremental or other polluting matter be placed or suffered to remain upon the bank or shore of any such source of water supply near the place from which such municipality shall or may obtain its supply of water for domestic use as aforesaid, nor within such distance thereof as may be considered unsafe by the Provincial Board of Health, after an examination thereof by a member or officer of the said board, and any person who shall offend against any provision of this section shall upon summary conviction be liable to a penalty of not more than \$100 for each offence, and each week's continuance after notice by the Provincial Board of Health or local board of health, to abate or remove the same shall constitute a separate offence.

*Quebec.*—Sec. 44. Every person who knowingly and voluntarily soils or contaminates, in any manner whatever, the water of a well, spring, stream, lake, pond, river, or reservoir, used for drinking by man or animals or every person who voluntarily soils or contaminates the intake of any aqueduct whether such intake be frozen or not, or every person who deposits in such intake or upon the ice thereof any carcass of any dead animal or any other matter injurious to health, is liable to a fine not exceeding one hundred dollars and in default of payment an imprisonment not exceeding two months.

*Saskatchewan.*—Sec. 22. When the construction, alteration or extension of common sewer or system of public sewerage is contemplated by the municipal council of any municipality or by any person or body corporate such council, person or body corporate shall submit to the commissioner all plans and specifications in connection

with the construction, alteration or extension of such common sewer or system of sewerage and in connection with the purification and disposal of the sewage.

(2) No common sewer or system of sewerage shall be established or continued unless there is maintained in connection therewith a system of sewage purification and disposal which removes and avoids any menace to the public health and the commissioner may call for and any council, person or body corporate shall when requested furnish as soon as may be such information and data in relation to such matters under their control as the commissioner may deem necessary.

Provided that with regard to systems in operation at the date of the passing of this Act the commissioner may dispense with the requirements hereof for a sufficient time in his opinion to permit of compliance therewith.

(3) It shall not be lawful for any such council, person or body corporate to construct, alter, extend or operate any common sewer or system of sewerage or sewage disposal without first obtaining from the commissioner a certificate stating that the proposed construction, alteration or extension may be carried out and the constructed or extended common sewer or system of sewerage and sewage disposal maintained and operated without injury or danger to the public health.

(4) If in the opinion of the commissioner for the purpose of guarding against injury or danger to the public health, alterations or additions are necessary in any existing or proposed common sewer or system of sewerage or in the plans or specifications submitted as aforesaid, the commissioner shall notify the municipality, person or body corporate, as the case may be, of the necessity of such alteration, and shall specify the same, and the aforesaid certificate shall not be granted until the alterations and additions specified in the said certificate have been made and adopted.

Section 23.—No by-laws providing for the raising of money for the construction, operation or extension of any system of waterworks or common sewer or system of sewerage or sewage disposal shall be submitted to the votes of the electors by the council of any municipality until the consent of the commissioner to the proposed construction, operation or extension has been first obtained under the provisions of sections 21 or 22 hereof, as the case may be, and the preamble to every such by-law shall declare that such consent has been duly obtained; no debenture shall be valid if issued under any by-law passed in contravention of the provisions of this section.

It will thus be seen that each province, with the single exception of New Brunswick, has placed in the hands of the provincial health authorities certain powers in regard to public water supplies and the construction of sewers and sewerage systems and the providing for the proper or adequate disposal of the sewage effluent. Many of these laws have been on the statute books for years. In some of the older provinces they have been amended, apparently with the object of preventing the pollution of the waterways, and thus, in a measure, they present evidence of good intention on the part of the legislatures to protect the public. Personal experience leads me to express the opinion that, in the main, they are non-efficient; they look well on paper, but in practice municipal authorities do pretty much as they please, and as the powers of most provincial boards of health are only advisory, they accept or reject the advice or recommendations of the board just as they see fit. Too frequently is it the case that the matter has already been voted upon by the ratepayers and passed by the municipal council—indeed, systems have often been known to be under construction, if not in actual operation, before the submission of the plans to the provincial authorities. The provincial laws, with the exception of Saskatchewan, lack all mandatory, restrictive or corrective power; other boards may recommend, direct or order, but in this new province, section 23 of the Act respecting the Public Health provides that the consent of the Commissioner of Health shall be obtained before any by-law providing for the raising of money for the construction, operation or extension of any system of waterworks, common sewer, system of sewerage or sewage disposal shall be voted upon by the ratepayers, and that no debenture shall be valid unless



this provision has been complied with. This new departure is restrictive, and if properly enforced will, it is hoped, go a long way in preventing what has been happening in older portions of the Dominion for some years. To have control over the actions of a municipal council through the purse strings should prove of marked advantage, and the operation of this statutory provision will be watched with interest by those desirous of securing for the people the best in both water supplies and sewerage purification.

If the question of the prevention of the pollution of public water supplies and the efficient disposal of sewage were merely matters for provincial control and interference, the problem might be left with the several legislatures to deal with. In some instances the protection of particular water supplies, such for instance as those at Fort William in Ontario, Truro and Halifax in Nova Scotia, certainly come under this head, but geographical or political boundaries are not based on the laws of hygiene; nor do the provincial laws of Quebec govern the resident ratepayer in Ontario, or vice versa. Still less do the laws of Ontario control or govern the acts of the foreigner, as for instance a resident in the State of Michigan or New York. The waters of the St. Lawrence river at Montreal, which should be comparatively pure, are polluted by the unlawful acts of the municipalities situated in Ontario as also by those of millions of the residents in the states of New York, Michigan, Ohio, &c., who wantonly pour millions of gallons of sewage daily into the waters of the Great Lakes. It is true those living within the bounds of Ontario are amenable to Canadian law, but what shall we say of our neighbours to the south of the international boundary line, many millions of whom transgress the laws of health by dumping garbage, factory waste and sewage wantonly into the Great Lakes system to the detriment of their own health as well as to that of the residents of Montreal?

It is therefore evident that the enactment and enforcement by any particular provincial government of laws regulating the disposal of sewage and providing for the protection of water supplies will not of itself safeguard even the people of the province to which those laws apply. Even if every province had similar or identical laws on this subject, the dangers respecting waters which are in part international in origin or location would not be entirely removed. This important aspect of the question is not confined to any particular province of Canada, although Ontario and Quebec are perhaps at the present time more particularly concerned owing to the fact that, lying to the south of the international boundary line, there are many millions of people discharging untreated sewage and factory wastes into rivers which discharge into the Great Lakes and their connecting rivers. What is happening in these provinces through the failure on the part of the governments concerned to deal with the situation by adequate statutory provisions should not be allowed to become the case in the other portions of Canada where the conditions are not so serious owing to sparsity of population.

It is quite apparent there are difficulties presented in dealing with this important question by reason of the fact that many of our streams and lakes flow not only through or between different provinces, but also between this country and the United States and are consequently international in character. The prevention of pollution by legislative enactment on this side of the line cannot therefore affect the action of the states lying to the south of the boundary. What shall we say of the pollution of the Great Lakes, where it is estimated by competent authorities that during a single season, as many as ten million persons travel in the ships plying on these waters? General Wyman, chief of the staff of the Public Health and Marine Hospital Service of the United States, in referring to the work of the interstate commission, known as the Lake Michigan Water Commission, gives his valuable opinion on this international aspect of the question. He says:—

‘The entire investigation is of vast importance and interest to the federal government because of its bearing on interstate commerce. It should receive

the active co-operation of the department, and there should be legislative action authorizing the Service to undertake the investigation of similar interstate bodies of water.'

To aid in an intelligent consideration, a résumé of the progress made in some of the states where the legislatures are alive to the importance of the subjects involved may be of interest. A brief reference can here be made only to those states having more advanced laws than others.

*Massachusetts.*—Massachusetts places in the hands of the State Board of Health the general oversight and care of all waterways, streams and ponds used by any municipality or public institution as sources of water supply, with power to examine into the purity of the same. The board may make rules and regulations for the protection of water supplies and publish the same in newspapers or by poster. Dr. F. W. Shunway, Secretary of the Michigan State Board of Health, says there are 'No weak spots in the law.'\*

*New Jersey.*—In the year 1900 the Senate and General Assembly of the State created a 'Sewage Commission,' amending and supplementing the Act in 1904 and 1907. At the present time the enforcement of these laws is in the hands of the State Board of Health. The powers of the commission in respect to pollution of waters are indicated in the following:—

'1. The State Sewerage Commission is hereby authorized and empowered to inspect any of the waters of this State, and if it finds that any of the waters of this State are being polluted in such manner as to cause or threaten injury to any of the inhabitants of this State, either in health, comfort or property, it shall be its duty to notify in writing any person, municipal or private corporation found to be polluting said waters, that prior to a time to be fixed by said commission, which time shall not be more than five years from the date of said notice, said person or corporation must cease to pollute said waters and make such other disposition of the sewage or other polluting matter as shall be approved by said commission; any person or corporation aggrieved by any such finding may appeal therefrom to the Court of Chancery at any time within three months after being notified thereof, and the said court is hereby authorized and empowered to hear and determine such appeal in a summary manner, according to its course and practice in other cases, and thereupon to affirm, reverse or modify the finding of said commission in such manner as it may deem just and reasonable.

'2. The State Sewerage Commission is hereby authorized to apply to the Court of Chancery for writ of injunction to prevent any violation of or enforce the provisions of this Act and the Act to which this is a supplement, and it shall be the duty of the said court, in a summary way, to hear and determine the merits of said application; and in all such cases to restrain violation of or enforce the provisions of the said Acts.

'3. "Waters of this State" as used in this Act and the Act to which this is a supplement shall include the ocean and its estuaries, all springs, streams and bodies, or surface or ground water, whether natural or artificial, within the boundaries of this State or subject to its jurisdiction.'

And it is further enacted that it is unlawful to build sewers so as to pollute streams or to discharge sewage except under conditions prescribed and approved of by the board. The Acts in this State, too, are not retroactive as regards the municipality polluting streams by the discharge from sewage systems which were in operation prior to the passing of the legislation above referred to. Crimes Act (revision) provides (section 82) that waters distributed for public use shall not be polluted; while Chapter 151, Laws of 1909, is similar in character to section 30, subsection 6, of the Ontario Public Health Act; it prohibits the pollution of potable waters in the following words:—

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\* First Report of the Lake Michigan Water Commission.

No excremental matter, domestic, factory, workshop, mill or slaughter-house refuse, creamery or cheese factory waste, garbage, dye stuff, coal tar, sawdust, tan bark or refuse from gas houses or other polluting matter, shall be placed in, or discharged into, the waters, or placed or deposited upon the ice of any river, brook, stream, or any tributary or branch thereof, or of any lake pond, well, spring or other reservoir above the point from which any city, town, borough, township, or other municipality shall or may obtain its supply of water for domestic use; nor shall any such excremental matter, domestic, factory, workshop, mill or slaughter-house refuse, creamery or cheese factory waste, garbage, dye stuff, coal tar, sawdust, tan bark or refuse from gas houses or other polluting matter, be placed or suffered to remain upon the banks of any such river, brook, stream, or of any tributary or branch thereof, or of any lake, pond, well spring or other reservoir above the point from which any city town, borough, township or other municipality shall or may obtain its supply of water for domestic use as aforesaid; and any person or persons, or private or public corporation, which shall offend against any of the provisions of this section, shall be liable to a penalty of one hundred dollars for each offence; and each week's continuance after notice by the State or local board of health to abate or remove the same, shall constitute a separate offence; *provided, however*, that nothing in this section contained shall be construed to repeal, modify or otherwise affect any law or statute now conferring upon any local board of health the power or authority to institute any proceedings in any court of this State for the recovery of any penalty, or obtaining any injunction against, the pollution of any of the waters of this State.'

*New York.*—New York enacted in 1885 that the State Board of Health might make rules for the inspection of water supplies, and in 1903 it was made unlawful to discharge sewage into any water without permission of the State Commissioner. The commissioner cannot order the discontinuance of any pollution which existed at the time of the passing of the Act. Thus what was, and is, manifestly an unlawful and unsanitary act on the part of all the large cities of that populous state, is perpetuated indefinitely.

*Kansas.*—Kansas enacted in 1907, with amendments in 1909, that all water systems existing at the time, must file with the State Board description, plans, &c., and that any additions or changes thereto could only be made with the approval of the board. Furthermore, the board may investigate if it has reason to believe that the sanitary quality of any water supply is prejudicial to the public health, and authority is vested in the State Board of Health 'to make an order requiring such changes in the source or sources of the said water supply or in the manner of sewage purification or treatment of the said supply before delivery to customers, or in both, as may in its judgment be necessary to safeguard the public health. It shall be the duty of the person, company, corporation, institution or municipality having the same in charge to fully comply with the order.' On the whole, the provisions of this law are more up-to-date than those of any other State. They lack, however, the retro-active powers.

*Ohio.*—Ohio has vested the control of the installation of waterworks systems and the methods of the disposal of sewage with the State Board of Health; old systems cannot be changed or added to without the approval of the board. The State Board together with the governor and the attorney-general may decide as to whether either an old system or any system of water supply or sewage disposal is detrimental to public health and may order the same to be changed. In the matter of interstate streams, this State has already taken action, the legislature having appointed a commission to recommend the measures to be taken to prevent the pollution of the Ohio river. It has also asked the legislatures of the States of Pennsylvania, West Virginia, Indiana and Kentucky, to co-operate by taking similar action. This commission is now at work and a report may be expected at an early date.



As regards the Susquehanna river, Pennsylvania and New York have taken joint action and in a like manner the pollution of the Delaware river has been considered by the same two states in conjunction with New Jersey.

As indicating the opinion of the chief State and provincial health authorities of this continent upon the subject of 'Pollution of Streams,' the report of a special committee presented at the Conference of State and Provincial Boards of Health, held in Washington, D.C., 1909, may be briefly stated. The committee, after a careful review of the important questions involved, recommended as follows:—

First.—That inasmuch as any discharge of organic matter into streams used as public water supplies is dangerous to public health, we recommend that such practices be disapproved.

Second.—That as an excessive discharge of organic matter into a stream creates a public nuisance, restricting its normal use and enjoyment, we recommend that partial purification be practised in such cases.

Third.—That the State boards of health represented present at every opportunity to the people generally the importance of the questions involved, and that those States not having effective legislation covering the subject shall endeavour to secure the same, with proper appropriations for conducting the work.

Fourth.—That the control of this work shall be placed in the hands of the State boards of health.

Fifth.—That the Federal Government be given such control that it may be in a position to assist the States in studying special problems, and that the conference heartily endorses the proposed Bill giving the Surgeon-General of the United States Public Health and Marine Hospital Service authority to investigate these questions as being a step in the direction of federal control in the prevention of the pollution of our streams and lakes.

*Great Britain.*—In regard to Great Britain, the present opinions in respect to the purity of rivers and other bodies of fresh water have not always prevailed. Public opinion has slowly developed. It was not until 1858 that pollution was prohibited in England by legal enactment, and in 1861 an Act was passed by the House of Commons which required sewage to be purified and freed from faecal and other putrescible matters before being discharged into the streams. Nothing definite was accomplished until 1865, when the First Royal Commission was appointed. This was followed in 1868 by the Rivers Pollution Prevention Commission, which dealt very fully with the questions of sewage purification. One of the instructions given this commission was as follows: 'Although it may be taken as proved generally that there is a widespread and serious pollution of rivers, both from town sewage and the refuse of mines and manufactories, and that town sewage may be turned to profitable account as a manure, there is not sufficient evidence to show that any measure absolutely prohibiting the discharge of such refuse into rivers, or absolutely compelling town authorities to carry it on the lands, might not be remedying one evil at the cost of an evil still more serious in the shape of injury to health and damage to manufactures.'

In 1869 a commission was appointed to specially consider the question of the disposal of London sewage, and largely as a result of the work of this latter commission the Local Government Board was founded in 1871, and the Public Health Act passed in the next year and subsequently amended in 1875. In 1876 the Rivers Pollution Prevention Act came into force. The amendment Act of 1875 stipulated that the Local Government Board should sanction the raising of loans for purposes of sewage disposal only after a favourable report was made by the inspector after a local inquiry. It further enacted that all town authorities should remove solids and faecal matter from sewage to such an extent that no nuisance should be caused, before its discharge into canals, rivers, lakes or the sea. The Act of 1876 gave the same Board power to require land treatment in all cases.

The general law relating to sewage disposal in England is to be found in the

Public Health Act, 1875, the Public Health Amendment Act, 1890, the Acts relating to London and also the Rivers Pollution Prevention Acts.

Sewage works may be constructed either within or without the district of a local authority. As regards the former class, all the existing sewers are vested in the local authority, and power is given to compulsorily purchase land and erect works for the treatment of sewage, either by natural or artificial means. Section 32, Public Health Act, 1875, gives the local authority power to construct sewage disposal works without the district, and prescribes procedure as follows:—

‘A local authority shall, three months at least before commencing the construction or extension of any sewer or other work for sewage purposes without their district, give notice of the intended work by advertisement in one or more of the local newspapers circulated within the district where the work is to be made. Such notice shall describe the nature of the intended work, and shall state the intended termini thereof, and the names of the parishes, and the turnpike roads and streets, and other lands (if any) through, across, under or on which the work is to be made, and shall name a place where a plan of the intended work is open for inspection, at all reasonable hours; and a copy of such notice shall be served on the owners or reputed owners, lessees or reputed lessees, and occupiers of the said lands, and on the overseers of such parishes, and on the trustees, surveyors of highways, or other persons having the care of such roads or streets.’

Sections 33 and 34 provide that objection may be taken and when taken prescribe that the work shall not be proceeded with unless the Local Government Board after enquiry and inspection, disallows or modifies the plans.

Under section 299, Public Health Act, 1875, power is given to the Local Government Board to enforce the performance of the duty of defaulting local authorities. They may enforce the same by writ of mandamus, or may appoint some person to perform the duty as prescribed. The section is as follows:—

‘Where complaint is made to the Local Government Board that a local authority has made default in providing their district with sufficient sewers, or in the maintenance of existing sewers, or in providing their district with a supply of water, in cases where danger arises to the health of the inhabitants from insufficiency or unwholesomeness of the existing supply of water and a proper supply can be got at a reasonable cost, or that a local authority has made default in enforcing any provisions of this Act which it is their duty to enforce, the Local Government Board, if satisfied, after due inquiry, that the authority has been guilty of the alleged default, shall make an order limiting a time for the performance of their duty in the matter of such complaint. If such duty is not performed by the time limited in the order, such order may be enforced by writ of mandamus or the Local Government Board may appoint some person to perform such duty, and shall by order direct that the expenses of performing the same, together with a reasonable remuneration to the person appointed for superintending such performance, and amounting to a sum specified in the order, together with the costs of the proceedings, shall be paid by the authority in default; and any order made for the payment of such expenses and costs may be removed into the Court of Queen’s Bench, and be enforced in the same manner as if the same were an order of such Court.

‘Any person appointed under this section to perform the duty of a defaulting local authority shall, in the performance and for the purpose of such duty, be invested with all the powers of such authority other than (save as hereinafter provided) the powers of levying rates; and the Local Government Board may from time to time by order change any person so appointed.’

Section 300 makes provision for recovery of expenses and sections 15 and 16 of the same Act provide for the maintenance of sewers and sewage works without the district.

As regards the purification of sewage, section 17 of the Act of 1875 provides as follows:—

‘Nothing in this Act shall authorize any local authority to make or use any sewer, drain, or outfall, for the purpose of conveying sewage or filthy water into any natural stream or watercourse, or into any canal, pond, or lake, until such sewage or filthy water is freed from all excrementitious or other foul or noxious matter such as would affect or deteriorate the purity and quality of the water in such stream or watercourse, or in such canal, pond, or lake.’

The Public Health Acts Amendment Act, 1890, prohibits the discharge into sewers of chemical refuse, waste steam, &c.

The requirements of the Local Government Board as regards sewerage and sewage disposal, have not been officially published hence the plans of any new works and of any proposed changes to existing plants must be submitted and each separately considered.

*The Rivers Pollution Prevention Act, 1876.*—The object of this Act is to make provision to prevent the pollution of rivers and to prevent the establishment of new sources of pollution. The sources dealt with are classified under the following heads:—

1. Solid refuse of any manufactory manufacturing process or quarry, or any rubbish, cinders or other waste, or any putrid solid matter.
2. Any solid or liquid sewage matter.
3. Any poisonous, noxious or polluting liquid from any factory.
4. Any solid matter from any mine in such quantity as to prejudicially interfere with the flow or any poisonous, noxious or polluting matter.

It is divided into six parts which, briefly described, are as follows:—

Part I makes it an offence for any person to put any solid matter, or any putrid solid matter, rubbish or cinders into any watercourse.

Part II prevents any person from allowing any solid or liquid matter to enter a watercourse.

Part III prohibits the draining of any waste material from any factory or mine into a watercourse, and the owners of the factory or mine must show to the Court, they are using the best reasonably available means to render the waste material harmless.

Part IV is administrative in character, and provides that sanitary authorities shall afford facilities enabling factories, &c., to drain into sewers; prescribes a maximum penalty not exceeding fifty pounds per diem for every day's continuance of the offence.

Parts V and VI are applicable to Scotland and Ireland only.

Apparently it was found this latter Act was a dead letter, for while section 3 provided that the throwing of solid matter into the streams and the pollution of them by sewage and manufactory refuse was prohibited, yet to secure a conviction it was necessary to prove that the solid matter was either putrid or putrescible, or that it polluted the waters of the stream, or that it was discharged in such quantities as to interfere with the due flow of the stream. Moreover, action could only be taken with the express sanction of the Local Government Board. Indeed, it would appear that in England, at least, the question of protection of streams and the disposal of sewage is complicated. Between the influence of the larger corporations controlling the larger water supplies, and that of the manufacturing interests, the health of the public is not protected as it should be, and much remains to be done by efficient and effectual legislation.

In addition to the foregoing, there is a series of Acts relating particularly to the city of London and its various authorities, vesting them with special provisions in respect to the sewerage area. Certain it is the various Acts of Parliament make it obligatory upon local authorities to purify the whole of the sewage before discharg-



ing it into any watercourse, but all the difficulties surrounding this important question are not as yet fully overcome, although royal commissions have been considering the question for many years.

The Commission of 1859 declared that the proper method of purifying sewage was to distribute it on land, and that only in this manner could the pollution of rivers be prevented. The Commission of 1868, which issued five reports up to 1874, also declared that land treatment was the only suitable method of rendering sewage non-putrescible, and that all other methods could only be regarded as palliatives. The 1882 Commission declared similarly. This Commission indicates that, whereas former Commissions were only able to judge of results by chemical methods, bacteriological methods had so far developed to be of use. The Commission of 1882 indicates that there are conditions which would permit of the Local Government Board relaxing its requirements as regards the land treatment. They further state they are convinced that by means of artificial biological processes effluents can be obtained non-putrescible in character and satisfactory enough to be discharged into streams without causing a nuisance.

It may be pointed out that the commissions of 1857, 1865 and 1868 had each recommended the formation of special authorities to supervise each watershed. The Commission of 1868 had considered a central authority necessary to deal with all matters relating to river pollution and to supervise the administration of the law, and this latter recommendation was again urged by the Commission in its third report, 1903, which claimed that to this central authority all appeals should be made rather than to the courts, as this method of appeal had been found costly and dilatory.

It is recommended that this central authority should have power to conduct inquiries, to call witnesses, to enter premises, to take samples of trade effluent and perform such other acts as are necessary for the performance of its duties. Its officers were to consist of an administrative head, a chemist an engineer and a bacteriologist.

The fourth report of this Commission deals with the pollution of tidal waters and recommends safeguards in the interest of the shell-fish industry as well as of the consumers.

In 1888 an effort was made to form joint committees having representatives from all sanitary authorities bordering on a particular river. That of the Mersey and Inwill seems to have been the most active, but it was soon found the existing legislation did not meet the situation and a step forward was made in 1892 when Parliament passed the Mersey and Inwill Act and, in 1894, the West Riding of Yorkshire Rivers Act. The chief feature of these Acts is that they give the committees special powers against the pollution of streams by solid matters and the pollution by sewage matter and liquid manufacturing refuse or waste. The value of these two Acts is greatly diminished by certain clauses which prevent prompt action being taken; inquiry by the Local Government Board and then three preliminary warnings, all having to precede action.

*Germany.*—In Germany the prevention of the pollution of the rivers which flow through several states would be a greater task were it not that the rivers are of large volume, for each state has its own laws upon the subject. Repeated attempts have been made to obtain Imperial legislation but the constitution seems to render this impossible. The Introductory Act of the Civil Code expressly places water legislation in the hands of the federated states; and further, the supervision and legislation regarding measures to be adopted by the Medical and Veterinary Police authorities is vested in the Imperial Government and the Epidemic Diseases Act, 1900, passed by the Imperial Legislature, provides that the methods for the disposal of waste shall be supervised by the State and that local authorities shall remove nuisances and adopt preventive measures against infectious diseases and, if it is necessary, that certain regulations shall apply to several states. The Imperial Chancellor is vested with power to see that the state authorities adopt uniform measures. Under the provisions

of section 43 of this Act the Imperial Council of Health was created, but its work, so far as river pollution is concerned, was restricted by the Federal Council, in 1901, to interstate waters. In this connection, it is interesting to note that the Imperial Government in 1903 declared that the keeping of the rivers and other public bodies of waters free from pollution was to be regarded as one of the main efforts of public health administration, and while the advisory reports of the Imperial Council of Health have no legal force, it is expected its pronouncements will produce good results.

The question of trade wastes is dealt with under the Trade Regulations which provide that local authorities shall consider the possibility of river pollution before granting a permit. The several federated states have each their own laws relating to river pollution.

*Prussia.*—In Prussia an order was issued in 1901 to the presidents of the various districts, in which it was pointed out that difference in local and economic conditions between various provinces made general legislation in Prussia impossible. The order indicated that the existing laws, together with a revision of the police regulations, would suffice for the present. It further pointed out that inspection should be made every two or three years of all streams at that time polluted or of which pollution was feared, bearing in mind the following:—

(1) The prevention of the spread of infectious diseases.

(2) The prevention of the pollution of water used for drinking or other purposes.

(3) The protection of the public against nuisances.

(4) The protection of fish.

The order further states that streams which are chiefly used for the drainage of villages and factories or having factories along their banks must be dealt with differently from those used for agricultural purposes or for fisheries. The actual state of things must always be considered and if, however, the water of the stream is necessary for domestic purposes must be taken against pollution.

*Saxony.*—The regulations of Saxony prevent the emptying of waste materials from pulp factories into the streams and apply also to all factories, the waste material of which would, of necessity, find its way, into streams and thus cause pollution killing or injuring fish, affecting the health of the community, or destroying natural beauty. There are no regulations which set forth the exact method of procedure on the part of factories for the prevention of contamination of streams, with the exception that waste material must be rendered inert before entering the same. The general economic principle of freedom in business enterprise and trade does not restrict the right of the authorities to prevent the pollution of streams in the interest of the public health. The closing of an establishment on account of water pollution can be ordered by the higher administrative authorities only. In such case the owner is reimbursed.

*Hamburg.*—In Hamburg no statutory provisions exist for the regulation of the disposal of sewage. The sewers are controlled by the municipal building department, which also constructs new works and keeps old ones in repair. The Department of Trade Inspection is authorized to take such measures as may be necessary to prevent the deterioration of existing sewers by chemical action or by erosion. The regulations of this department, however, are merely instructions given to individual, industrial or other establishments, from time to time, each case being separately considered and decided. Before promulgating its instructions the Department of Trade Inspection consults representatives of the building and fire departments or other appropriate official bodies likely to have an interest in the particular matter.

This brief review of the situation in European countries is given to indicate what is being done in these crowded centres of civilization, and to point out that

while many difficulties have been overcome, as yet no definite conclusions have been arrived at in the way of statutory enactments. Indeed, it may be said that legislation along these lines is progressive—finality has not been arrived at anywhere. On the other hand, it is a case everywhere of study, but, while studying, organize the work under a central health authority and give that authority power to prevent—conserving the good which is left unpolluted, taking care that what is bad shall not be made worse, and striving to improve all.

A study of the map\* of the watersheds of Canada indicates the interprovincial and international character of some of the more important watersheds of the Dominion. The provinces of Nova Scotia and Prince Edward Island, by reason of their insular position, are exceptions to the general rule, while British Columbia is an example where failure to protect its own rivers might be a menace to the states lying to the south. Alberta, on the other hand, is an example where, owing to the flow of the rivers easterly through Saskatchewan, the difficulties are local and interprovincial. In Saskatchewan and Manitoba the questions are also local and interprovincial; while in Manitoba, owing to the fact that the watersheds of the Assiniboine and Red rivers lie largely to the south of the international boundary line, chiefly in North Dakota and Minnesota, the problem assumes an international aspect. The pollution of the Great Lakes is to a great extent international, since they receive a portion of their waters from the States of Minnesota, Michigan, Ohio, New York, Vermont, New Hampshire and Maine. The pollution of the Ottawa river, the interprovincial boundary between Ontario and Quebec, makes the question of pollution of the watershed of that river of interprovincial interest, the chief sources of contamination being in the former province. In New Brunswick, the question is local but chiefly international, owing to the fact that a portion of the watershed of the St. John river lies within the State of Maine.

It is not contended that the dangers at present existing in the various provinces are identically the same either in degree or in fact, but there exists the same underlying principle in that provincial legislation alone will not solve the difficulties. It requires some other authority, viz., that of the Federal Government, to deal with them, particularly those of an international character. It will be for the Commission of Conservation to investigate the various watersheds, collecting all available data with the assistance of the several provincial and local health authorities in order correctly to estimate the character, quantity and variety of the various pollutions at present existing and to ascertain their exact points of discharge and their bearing upon the present sources of water supply of towns and cities, both near and remote from the points of discharge; and further, to consider and recommend ways and means for the abatement of these nuisances, having always in mind that the health of the citizens of this country is paramount, but ever remembering the necessity for the fostering of agriculture and the development of manufactures.

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\* Map No. 33 in the Department of the Interior's Atlas of Canada, 1906, is very satisfactory.



## EXHIBIT No. 5.

CITIES, TOWNS AND VILLAGES WITH POPULATION OF UPWARDS OF  
1,000 THAT DISCHARGE INTO NAVIGABLE WATERS.*(Submitted by Mr. James White.)*

\* The division of towns that discharge their sewage into navigable waters from those that do not, is, to a certain extent, an arbitrary one. Thus Amherst, N.S., discharges its sewage into the La Planche river, two or three miles from the Bay of Fundy. As this is virtually the same as discharging into the bay, it is so listed. Again, Niagara Falls, Ont., discharges sewage into the Niagara river where it is unnavigable but, as the river is navigable above and below the city, it has been included among the municipalities that discharge into navigable fresh waters.

## ALBERTA.

Into fresh water.

Edmonton,  
Lethbridge,  
Medicine Hat,  
Strathcona,  
Fort Saskatchewan.

Into tidal water.

## BRITISH COLUMBIA.

Enderby,  
Kamloops,  
Kaslo,  
Kelowna,  
New Westminster,  
Revelstoke,  
Trail.

Cumberland,  
Ladysmith,  
Nanaimo,  
North Vancouver,  
Prince Rupert,  
Vancouver,  
Victoria.

## MANITOBA.

Brandon,  
Portage la Prairie,  
St. Boniface,  
Winnipeg,  
Emerson,  
Morris,  
Selkirk,  
Gimli,  
St. Laurent,  
Winnipeg Beach,  
Winnipegosis.

## NEW BRUNSWICK.

Fredericton,  
Moncton,  
St. John,  
Bathurst,  
Campbellton,  
Chatham,  
Dalhousie,  
Marysville,  
Newcastle,  
Richibucto,  
St. Andrews,  
Sackville,  
Shediac.

## NOVA SCOTIA.

Sussex.

Dorchester,  
Gagetown,  
Hampton,  
Hillsborough,  
Halifax,  
Sydney,  
Amherst,  
Annapolis Royal,

## SELECT SPECIAL COMMITTEE

NOVA SCOTIA—*Concluded.*

Into fresh water.

Into tidal water.

Antigonish,  
 Bridgetown,  
 Canso,  
 Dartmouth,  
 Digby,  
 Glace Bay,  
 Hantsport,  
 Inverness,  
 Liverpool,  
 Lockeport,  
 Louisburg,  
 Lunenburg,  
 New Glasgow,  
 North Sydney,  
 Parrsboro,  
 Pictou,  
 Port Hawkesbury,  
 Port Hood,  
 Shelburne,  
 Sydney Mines,  
 Trenton,  
 Truro,  
 Wedgeport,  
 Windsor,  
 Wolfville,  
 Yarmouth.

## ONTARIO.

Belleville,  
 Chatham,  
 Fort William,  
 Hamilton,  
 Kingston,  
 Niagara Falls,  
 Ottawa,  
 Peterborough,  
 Port Arthur,  
 St. Catharines,  
 Toronto,  
 Windsor,  
 Amherstburg,  
 Arnprior,  
 Barrie,  
 Blind River,  
 Bowmanville,  
 Bracebridge,  
 Brockville,  
 Bruce Mines,  
 Cache Bay,  
 Campbellford,  
 Cobourg,  
 Collingwood,  
 Cornwall,  
 Deseronto,  
 Dundas,  
 Dunnville,  
 Fort Frances,  
 Gananoque,  
 Goderich,  
 Gore Bay,  
 Gravenhurst,  
 Haileybury,  
 Hawkesbury,  
 Huntsville,  
 Keewatin,  
 Kenora,  
 Kincardine,  
 Lindsay,  
 Little Current,  
 Mattawa,  
 Meaford,

ONTARIO—*Concluded.*

Into fresh water.

Into tidal water.

Midland,  
Napanee,  
New Liskeard,  
Niagara,  
North Bay,  
North Toronto,  
Oakville,  
Orillia,  
Oshawa,  
Owen Sound,  
Parry Sound,  
Pembroke,  
Penetanguishene,  
Perth,  
Picton,  
Port Hope,  
Prescott,  
Rainy River,  
Rockland,  
Sandwich,  
Sarnia,  
Sault Ste. Marie,  
Smith's Falls,  
Steelton,  
Sturgeon Falls,  
Thessalon,  
Thornbury,  
Thorold,  
Trenton,  
Walkerville,  
Wallaceburg,  
Welland,  
Whitby,  
Warton,  
Bridgeburg,  
Brighton,  
Burlington,  
Cardinal,  
Eastview,  
Fenelon Falls,  
Fort Erie,  
Grimsby,  
Kemptonville,  
Lakefield,  
L'Orignal,  
Merriton,  
Mimico,  
Morrisburg,  
Port Colborne,  
Port Dalhousie,  
Port Dover,  
Port Elgin,  
Port Perry,  
Portsmouth,  
Southampton,  
Victoria Harbour.

PRINCE EDWARD ISLAND.

Charlottetown,  
Summerside.

QUEBEC.

Hull,  
Montreal,  
Sorel,  
Trois-Rivières,  
Westmount,  
Aylmer,  
Beaconsfield,

Quebec,



QUEBEC—*Concluded.*

## Into fresh water.

Beauharnois,  
 Berthier,  
 Bordeaux,  
 Chicoutimi,  
 Dorval,  
 Fraserville,  
 Iberville,  
 Lachine,  
 Lachute,  
 L'Assomption,  
 Laprairie,  
 Lévis,  
 Longueuil,  
 Louiseville,  
 Maisonneuve,  
 Montreal West,  
 Nicolet,  
 Outremont,  
 Pointe-aux-Trembles,  
 Pointe Claire,  
 Rigaud,  
 Roberval,  
 Ste. Anne de Bellevue,  
 St. Jean,  
 St. Lambert,  
 St. Laurent,  
 St. Ours,  
 Salaberry de Valleyfield  
 Summerlea,  
 Terrebonne,  
 Verdun.

## Into tidal water.

Montmagny,

Rimouski.

## SASKATCHEWAN.

Prince Albert,  
 Saskatoon,  
 Battleford,  
 North Battleford,  
 Outlook.

## YUKON.

Dawson,  
 White Horse.

## EXHIBIT No. 6.

(Submitted by Dr. Hodgetts.)

## DEATHS BY TYPHOID FEVER IN 1911.

## ONTARIO.

Cities.	Population.	Number of Deaths.	Rate per 100,000.
Belleville.....	9,876	2	20
Brantford.....	23,132	17	73
Chatham.....	10,770	4	37
Fort William.....	16,499	7	42
Guelph.....	15,175	2	13
Hamilton.....	81,969	18	22
Kingston.....	18,874	5	26
London.....	46,300	8	17
Niagara Falls.....	9,248	8	86
Ottawa.....	87,062	37	100
Peterboro.....	18,360	3	16
Port Arthur.....	11,220	16	142
St. Catharines.....	12,481	9	72
St. Thomas.....	11,051	3	26
Stratford.....	12,946	2	15
Toronto.....	376,538	82	22
Windsor.....	17,829	6	33
Woodstock.....	9,320	4	43
Barrie.....	6,420	1	15
Berlin.....	15,196	1	6
Brockville.....	9,374	4	42
Cobalt.....	5,638	3	53
Cobourg.....	5,074	4	78
Collingwood.....	7,000	3	43
Cornwall.....	6,598	3	45
Galt.....	10,299	3	29
Kenora.....	6,158	1	16
Lindsay.....	6,964	2	21
North Bay.....	7,737	7	90
North Toronto.....	5,362		
Orillia.....	6,828	4	58
Oshawa.....	7,436	2	27
Owen Sound.....	12,558		
Pembroke.....	5,626	7	124
Port Hope.....	5,092	3	60
Sarnia.....	9,947	14	140
Sault Ste. Marie.....	10,984	35	290
Smith's Falls.....	6,370	1	15
Welland.....	5,318	3	56
Province.....	2,523,274	637	25
Cities.....		283	
Towns.....		101	
Rural.....			

Province:—1902.....	392
1903.....	391
1904.....	482
1905.....	446
1906.....	891
1907.....	520
1908.....	662
1909.....	669
1910.....	706
1911.....	637

Total . . . . . 5,796

NOTE.—Population statistics are taken from Census Returns of 1911.

## PROVINCE OF QUEBEC.

Cities.	Population.	Number of deaths, 1911-12.	Death rate per 100,000.
Hull.....	18,222	.....	31
Montreal.....	470,480	146	31
Quebec.....	78,190	18	23
St. Hyacinthe.....	9,797	8	82
Sherbrooke.....	16,405	4	24
Sorel.....	8,420	3	35
Three Rivers.....	13,691	33	240
Westmount.....	14,579	.....	.....
Towns :—			
Chicoutimi.....	5,880	2	34
Fraserville.....	6,774	1	14
Joliette.....	6,346	2	31
Lachine.....	10,699	.....	.....
Levis.....	7,452	8	107
Maisonneuve.....	18,684	3	16
St. John.....	5,903	1	17
Thetford Mines.....	7,261	2	27
Valleyfield.....	9,449	2	21
Verdun.....	11,629	3	26
St. Louis.....	.....	.....	.....
Province.....	2,002,712	930	36

Rate per 100 :—1902.....	1.4
1903.....	1.5
1904.....	1.7
1905.....	1.3
1906.....	1.6
1907.....	1.7
1908.....	1.4
1909.....	1.8
1910.....	1.5
1911.....	1.9

## MANITOBA.

Cities.	Population.	Number of deaths, 1910.	Death rate per 100,000.
Brandon.....	13,839	22	158
Portage la Prairie.....	5,892	4	68
St. Boniface.....	7,483	40	534
Winnipeg.....	136,035	43	31
Towns of 1,000 and over :—			
Carmen.....	1,271	3	23
Dauphin.....	2,815	4	1,420
Emerson.....	1,043	.....	.....
Killarney.....	1,010	.....	.....
Minnedosa.....	1,483	.....	.....
Morden.....	1,130	3	265
Neepawa.....	1,864	1	53
Selkirk.....	2,977	2	67
Souris.....	1,854	.....	.....
Stonewall.....	1,005	.....	.....
Virten.....	1,550	2	129
The Province.....	455,614	174	38
Urban.....	.....	109	.....
Rural.....	.....	65	.....



## BRITISH COLUMBIA.

Cities.	Population.	Number of Deaths		Death rate per 100,000.
		1911	1912	
Province.....	392,480	92	99	23
Victoria.....	31,660	6	2	18
Cowichan.....			1	
Nanaimo.....	8,306	1	..	12
New Westminster .....	13,199	7	9	53
Kamloops.....	3,772	2	34	53
Revelstoke.....	3,017		4	
Golden, Windermere.. ..			3	
Fernie.....	3,146		9	
Cranbrook.....	3,090		13	
Nelson.....	4,476		1	
Kaslo.....	722		1	
Atlin.....				
Prince Rupert.....	4,184			
Hazelton .....				
Telegraph Creek.....				
Vancouver.....	100,401	39	20	38
Comox.....			1	
Chilliwack ..	1,657	1	.....	60
Ladner .....				
Kootenay.....		31		
Skeena, Stikine, Atlin, Omineca.....	(1906) 37	4		

## NOVA SCOTIA.

		1910.	
Digby .....	1,247	1	
North Sydney.....	5,418	1	
Parrsboro.....	2,856	1	
Stewiacke.....	633	1	
Yarmouth .....	6,600	1	
Glace Bay .....	16,562	9	
New Glasgow.....	6,383	2	
Springhill .....	5,713	2	
Sydney Mines.....	7,470	2	
Cape Breton County.....		17	
Cumberland County .....		12	
Digby County.....			
Halifax County.....		6	
Richmond County ..			
Victoria County.....			
Colchester County.....		11	
Province.....	492,338	74	
Towns.....		38	
Rural Districts .....		36	

## PRINCE EDWARD ISLAND.

		1909.	1911.
Province.....	93,728	15	16

## NEWFOUNDLAND.

		1909.	
Colony (1901).....	217,037	37	
St. John's, E.W.....		10	
Port-de-Grave .....		1	
Harbor Grace .....		1	
Bay-de-Verde.....		1	
Trinity.....		4	
Bonavista.....		7	
Fogo.....		3	
Twillingate .....		7	
Burin.....		2	
Pl. and St. Mary's.....		1	

EXHIBIT No. 6a.

(Submitted by Mr. Joseph Race, F.I.C.)

TYPHOID RATES (DEATHS PER 100,000) OF SOME COUNTIES AND TOWNS ON THE OTTAWA RIVER.

	Nipissing.	Renfrew.	Lanark.	Carleton.	Russell and Prescott.
1900.....	48	25	15	29	12
1901.....	70	27	21	15	23
1902.....	40	21	13	25	17
1903.....	59	13	15	7	27
1904.....	100	23	5	19	17
1905.....	137	27	5	19	17
1906.....	300	66	24	35	21
1907.....	150	31	18	42	29
1908.....	129	40	18	27	28
1909.....	493	48	47	23	29
1910.....	200	26	18	27	27
1911.....	34	27	18	87	12

These rates were calculated from the information given in the reports of the Registrar for the Province of Ontario.

	Ottawa.	Hull.	Pembroke.
1900.....	39	.....	.....
1901.....	21	.....	.....
1902.....	16	7	.....
1903.....	9	14	.....
1904.....	20	13	.....
1905.....	20	46	.....
1906.....	30	39	.....
1907.....	51	50	44
1908.....	26	48	250
1909.....	30	31	292
1910.....	27	6	116
1911.....	91	.....	116

The recorder vital statistics for the province of Quebec reports that these returns are incomplete.

The Hull returns are calculated from the data given in Dr. Hodgetts report on the epidemic of 1911, the Pembroke ones from the provincial Register's reports, and the Ottawa figures partially from the health department data and partially from the provincial returns.

## EXHIBIT No. 7.

## COST OF SEWERAGE SYSTEMS.

*(Prepared by Dr. Hodgetts.)*

## BRIDGEBURG (SEPARATE SYSTEM).

Population, 1,500.

Eight miles of 8, 10, 12, 15 and 18-inch pipes.

Estimated cost:—

Sewers, manholes and flush tanks, including \$33,000 for rock excavation.. . . . .	\$110,000
Septic tank and iron pipe outlet (280 ft. of 18 cast iron pipe).. . . . .	5,000
Cost of site of disposal works.. . . . .	10,000
	<hr/>
	\$125,000

Additional cost should further purification be required:—

1. Contact beds.. . . . .	} \$10,000
2. Pumping plant for elevating one day's flow of sewage 20 feet.. . . . .	
3. High level and low level covered concrete reservoirs..	
4. The necessary mains.. . . . .	

## SEWAGE DISPOSAL FOR PALMERSTON.

Population, 2,000.

Inland town—discharge into branch of Maitland river.

Quantity of sewage, 100,000 gals. daily.

Capacity of disposal work, 170,000 gals. daily.

Cost of plant:—

Liquifying tanks.. . . . .	\$2,787 60
Sprinkling filters, piping, &c.. . . . .	4,361 00
Sand filter.. . . . .	2,483 00
Sludge beds.. . . . .	300 00
Storm water basin.. . . . .	1,028 00
3½ acres of land at \$75 per acre.. . . . .	262 00
Sundry expenses.. . . . .	.....
	<hr/>
	\$13,798 60
Add 15% for contingencies.. . . . .	2,069 40
	<hr/>
	\$15,868 00



## PRESTON (SEPARATE SYSTEM).

Population, 3,800.

Town divided into 2 watersheds, hence 2 disposal plants, effluent discharged into River Speed.

W. Mahlon Davies, C.E., estimated cost:—

## West Disposal works—

Land and rights of way.. . . .	\$ 375	
Covered concrete tank, 40,000 gals.. . . .	1,400	
Grading and draining beds... . . . .	1,600	
		<hr/>
		\$ 3,375

## West Trunk sewer—

1,550 feet 15-in. sewer pipe at 44c.. . . .	\$ 660	
1,386 feet 12-in. sewer pipe at 33c.. . . .	457	
Trucking and back filling.. . . .	1,843	
Manholes... . . . .	316	
		<hr/>
		3,276

## East Disposal works—

Land.. . . .	\$ 150	
One tank... . . . .	1,400	
Coke contact beds.. . . .	1,952	
		<hr/>
		3,502

## East Trunk sewer—

3,500 feet 12-in. pipe for sewer.  
2,000 feet 12-in. pipe for subsoil drain.

5,500 feet at 33c.. . . .	\$1,815	
Manholes... . . . .	264	
Trucking, laying and backfilling.. . . .	1,990	
		<hr/>
		4,069

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\$14,222

Contingencies.. . . . 1,422

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\$15,644

Estimated cost of laterals at \$1.30 per lineal foot including cost of all house connections to the property line or 65c per foot frontage on each side of the street. The cost for these laterals extended over a term of 30 years would mean 3¼ cents per lineal foot per annum.





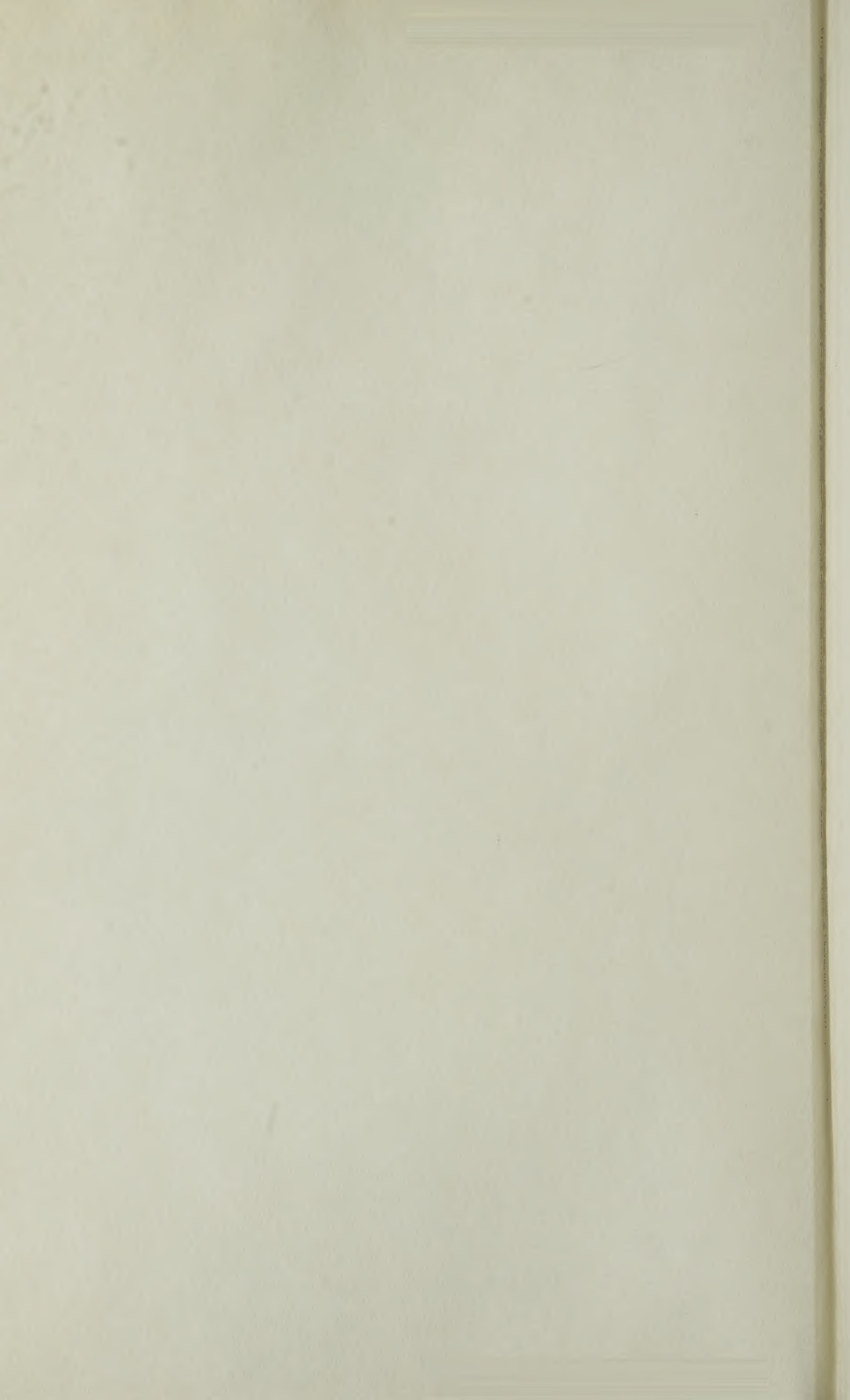












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